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A Pharmaceutical Engineering Number

An Inspirational Number

A Pharmaceutical Horizon Unlimited Number

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Suggestions for New Objectives in Pharmaceutical Education*

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The educational requirements for most professions have been progressively increasing. Pharmacy is no exception. However, the conception of educators, generally, of what constitutes pharmacy has been so much limited to retail pharmacy that pharmacists, to a great degree, have been crowded out of certain areas of their own profession. The result has been that, essentially, students have been prepared for only one branch of the industry, the retail branch, with a further consequence that there is an over abundance of retail pharmacists, many more than are necessary to serve adequately the public health requirements.

Some interests among those whose livelihoods are gained within the pharmaceutical industry have, particularly during the past few years, been pointing with great alarm to the so-called "shortage" of pharmacists in the retail trade. Steps have been taken to increase the enrollments in our colleges of pharmacy, both to "save" some colleges and to reverse the growing pharmacist "shortage."

Such measures, it seems to me, affect pharmacy as a profession adversely and would appear to have for their objectives (1) the retaining and introduction of as many side lines as possible in drug stores or pharmacies, (2) encouraging the establishment of still greater numbers of so-called drug stores so that manufacturers and wholesalers of sundry merchandise might obtain more counter space for display of their non-public health merchandise to the public, and (3) increasing the number of pharmacists engaged in retail

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practice to the point where the supply will be in still greater excess of the public health requirements.

From a strictly pharmaceutical point of view, such objectives, in my opinion, are diametrically opposed to the creation of a healthy, vigorous, bona fide profession which we call pharmacy. The objectives of pharmacy and pharmaceutical education must not be permitted to be influenced adversely whereby the progressive trend toward higher educational and professional standards would be retarded or reversed to the disadvantage and commonality of the areas of pharmacy as a profession.

From the point of view of pharmacy as a scientific profession, why should drug stores or pharmacies sell such non-public health goods as non-surgical hardware and electrical goods, soft drinks, foods, tobaccos and other assorted products which have no essential relationship to the profession of pharmacy? Pharmacists want to get back to pharmacy but they cannot do so completely while the existing, uneconomic, unwarranted number of registered pharmacists in retail activities is out of proportion to the public health requirements. The situation may be partly corrected when the students in colleges of pharmacy are provided the opportunity to prepare for other branches of the industry which have until the present been almost totally disregarded by educational leaders. One reason for this condition, I believe, may be that educators who have had to do with the establishment or revision of curricula, or I should more properly say the curriculum, have not sought the advice and opinions of properly qualified representatives of the various branches of the pharmaceutical industry to determine adequately what are the current, much less the prospective educational requirements for suitable training of personnel who may be best qualified for the ultimate job to be done.

Educational leaders should think in terms of pharmaceutical progress for the industry as a whole. Some are advocating a minimum five year course, that is a two-three plan, for pharmacy graduation. There is, in my opinion, real justification for it.

That plan would enable students to choose and pursue professional courses of their choice after ample time for observation and mature deliberation. The five year course, that is, two year prerequisite plus three years professional, is increasingly necessary as a minimum because of the progressively greater demands upon the pharmacist by the medical profession for scientific information.

I expect, in fact, to see before long one of our outstanding pharmacy colleges go on a two-four basis, that is, two years prerequisite and four years professional, as its standard pharmacy course. The dean's idea is that pharmacy students need better educations before being admitted to a well planned four year professional course. If it is good for physicians, it is good for pharmacists; certainly if it is advantageous for physicians, it is advantageous for pharmacists. I urge all of you to read the article entitled "The Road Ahead in Pharmacy Education" by Dr. H. Evert Kendig, Dean, Temple University School of Pharmacy, Philadelphia, which article was published in *The Merck Report* for July 1945; also his speech before the New Hampshire Pharmaceutical Association, September 16, 1946, entitled "Pharmaceutical Education for the Future."

More and more the professionally minded pharmacist is becoming or is required to be a consulting pharmacologist. That is as it should be. In many instances that is as important a phase of his business as compounding, yet some pharmacy colleges, at least, do not teach pharmacology of medical college grade.

The pharmacist, which name implies an expert in the knowledge of drugs, should have equally as good a knowledge of the pharmacology of drugs as does the physician, but of course the pharmacist should know more drugs, all drugs. That is his profession. That implies a prerequisite of physiology and gross anatomy of medical college grade.

The two-three or two-four course in pharmacy should and would enable graduates to enter directly the study of medicine. A certain percentage usually make up their minds

to do so about the time they graduate from pharmacy, or a year or two thereafter. They should not be "saddled" with the handicap of inability to qualify for the pre-medical requirement after completting a standard course in pharmacy which is so closely allied with the practice of medicine. They cannot as a rule meet medical school entrance requirements today because they do not have all the prerequisites, which deficiency seems to me to be unfortunate. I do not mean to turn pharmacy colleges into pre-medical training schools but I do say that the prerequisites for medical college entrance should be found within the pharmacy curricula.

The more pharmacy graduates who subsequently study and graduate in medicine, the closer will the two professions be bound to each other, and obviously the better will be the understanding, the interprofessional relations, and the cooperation between the two. Therefore pharmacy graduates who are so inclined should be encouraged to consider the study of medicine. Pharmacy should be well represented in all branches of endeavor where pharmaceutical knowledge is an asset.

In that connection, I think pharmacy students should have a good introduction into the reading or study of medical literature. Certainly they should have a good acquaintanceship with the Journal of the American Medical Association. That should be developed over the full span of the years of college attendance. It will help to prepare them for their every day practical contacts with physicians which is so important to the success and real professional attainment of the present day pharmacist and especially of the pharmacist of tomorrow. In how many pharmacies and drug stores does one find the Journal of the American Medical Association? How many pharmacists subscribe to it? How many pharmacists know they are permitted to subscribe to it? The subscription price is $8.00 per year for 52 weekly issues, less than $0.16 per issue. The column on "Tonics and Sedatives" is worth more than that. How many pharmacists have medical dictionaries to aid them in the reading and studying of medical literature?

The reading or studying of the J.A.M.A. will help the pharmacist to discuss medical cases with the physicians who come to him for information on new or old drugs, and some to discuss or talk about medical cases. Not that the pharmacist is going to advise physicians how to practice medicine, but it does help to make better and more understanding conversation between them which obviously brings people closer together since it makes them feel they have a great deal more in common. While pharmacy is not a branch or division of medicine, the two professions are probably more interdependent than any other two professions. For that reason, pharmacists should be able well to speak the physicians' language. Regular reading of the Journal of the American Medical Association will do an immeasurable amount of good toward attaining that objective.

Many pharmacy colleges today are over-crowded or at least filled to the limit of their capacity, preparing students for retail pharmacy only, an already over-crowded branch of the pharmaceutical profession. Thus they have the moral responsibility of preparing students for a branch of a profession in which, as such, most of them will be unable to gain a livelihood without resorting to the sales promotion of merchandise unrelated to the practice of pharmacy or of medicine.

In 1945, it is said, there were about 315 million prescriptions filled in the United States. There were about 82,000 licensed pharmacists, about 12,000 of whom are normally in other than retail pharmacy. Thus only about 15 prescriptions are filled per pharmacist per day, six days per week, not counting pharmacists engaged in other than retail and hospital pharmacy. A pharmacist can easily fill 50 to 60 average prescriptions per day. On this basis there are at least three times too many pharmacists for that single purpose, but, for the sake of conservatism, let us say that there are at least twice too many, so as to allow pharmacist proprietors a little time for executive duties and the other pharmacists some time to sell other public health supplies to patients, and medical supplies to physicians, dentists and veterinarians.

If we may accept the reasonable assumption that the *average* pharmacy should maintain three pharmacists, including the proprietor, then about 24,000 drug stores would absorb all the pharmacists engaged in retail pharmacy in the United States, whereas, in 1945 there were approximately 52,000 pharmacies and so-called drug stores. This would indicate that there are at least twice too many drug stores. The over-abundance of so-called drug stores is particularly apparent in larger cities, but exists in practically every town of two or more drug stores as distributed today.

Let us divide 315 million prescriptions among 24,000 drug stores. On a six day week basis that would be 44 prescriptions per store per day. Obviously 44 prescriptions per store per day are not sufficient to justify the services of three pharmacists, in fact should require scarcely one pharmacist's time. So again, on a prescription basis there is the indication that there is an over-abundance of retail pharmacists.

Assuming that 24,000 drug stores should confine their activities solely to prescription compounding and filling, and the selling of drug products, sickroom or physicians supplies and related public health needs, they should do a yearly *minimum* sales volume of about $1,750,000,000 to $2,000,000,000 without apprentice assistance. During the year 1945 the total volume of sales in drug stores, of drug and truly related health products only, was approximately $1,285,000,000 while total sales of all such products in all types of retail outlets was approximately $2,000,000,000[1]. That includes toilet soap sales. It is therefore readily seen that 24,000 drug stores mentioned above, each employing an average of three pharmacists, could easily handle more than the total purely prescription, drug, sickroom and physicians supplies and related public health products demanded by the total population of the United State in 1945. That again indicates that there is an over-abundance of establishments labeled drug stores, and too many drug store pharmacists. Further evidence is the fact that approximately 75% of the

prescription business is done by approximately 10% of the pharmacies and drug stores[2] and about 95% by 40% respectively.

Leaders in pharmacy, on January 18, 1944, requested the Selective Service to permit certain student groups to remain in pharmacy colleges until graduation. "This request was firmly denied on the grounds that the armed forces did not need any more pharmacists and that there is still a sufficient number of civilian pharmacists in active practice adequately to serve the needs of the public if they will give their time to the practice of pharmacy and not to merchandising and other activities"[1].

A pharmaceutical educator must feel the futility of working diligently to impart to students his best professional knowledge and then to have so many of them engage in the selling of products unrelated to the practice of pharmacy. Such practice is not pharmacy. How many pharmacy colleges teach the ethics of the profession?

It is apparent then that it is to the best interests of prospective students, pharmacists, colleges of pharmacy, and the pharmaceutical profession as a whole, that colleges of pharmacy de-emphasize preparation for retail pharmacy and instead direct or guide as many suitable students as possible into pharmaceutical curricula leading to specialization in other branches of the pharmaceutical industry.

There are 69 colleges of pharmacy in the United States, one college to approximately 1,200 registered pharmacists, while there are 66 medical colleges, one college to approximately 2,600 physicials. Obviously there are too many colleges of pharmacy, on the basis of the present range of curricula.

Colleges of pharmacy should not, in my opinion, limit their training so as to be suitable, essentially, for only one branch of pharmacy. The requirements of the manufactur-

ing branch of the industry, where about 70% of the pharmaceutical compounding is done and by whom a good proportion of the promotional work is carried on, appears to have been overlooked to a very great degree. In fact some educators have discouraged students from thinking of engaging in other than retailing activities. As a result, manufacturers have had to look to schools of chemistry and chemical engineering to supply the scientific personnel.

Thus pharmacy colleges have not only in a great measure closed the door to pharmacists where the greatest proportion of the profession of pharmacy is being practiced in a highly scientific manner, but have likewise closed the door to innumerable grants and scholarships for research work, to say nothing of bequests, which have gone instead to schools of chemistry and of medicine.

They have given too little thought to the preparation of pharmacists for the professional service and sales work carried on by manufacturers, for executive positions wherein a pharmaceutical education is advantageous, for production and research positions, for editorial positions with pharmaceutical journals, or for executive positions with advertising agencies handling pharmaceutical accounts.

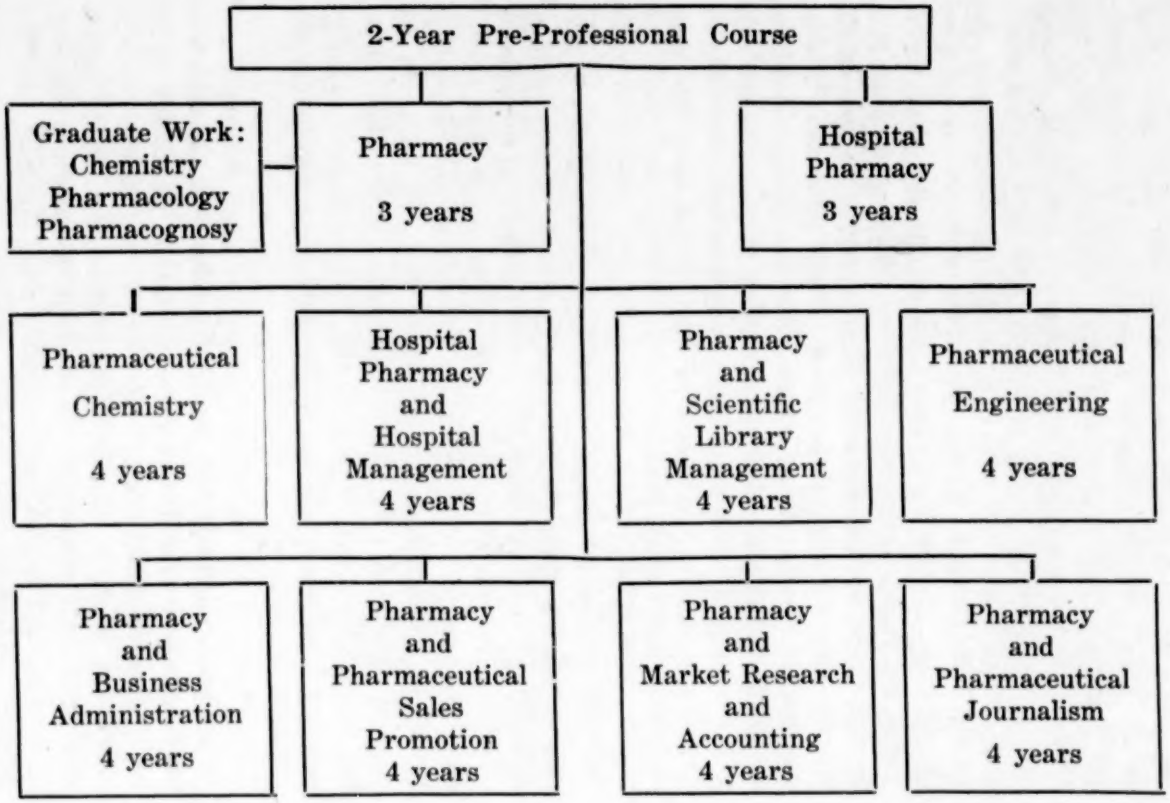
Trade and professional journals are very influential in shaping a profession's policies and in leading it along certain pathways. There are many excellent opportunities for pharmacists in the journalistic and advertising fields.

There are many pharmacy graduates who are executives, salesmen or professional service pharmacists (representatives) associated with the several hundred wholesale druggists and the many pharmaceutical manufacturers in the United States. *There* is an important sphere of influence and a source of a great many splendid opportunities. Pharmaceutical educators should encourage graduates to seek those opportunities after they have had some retail pharmacy experience which is desirable.

Pharmacy colleges are very influential. They have on the whole done a splendid job so far as they have gone. As a group, they have for a number of years been stressing hospital pharmacy and professional retail pharmacy operations. Hospital pharmacies have been increasing greatly in number during the past few years especially, and have gained much and enviable prestige with the medical profession and the public. The same can be said about the exclusive prescription pharmacies, frequently referred to as ethical pharmacies, which are rapidly garnering the prescription and other professional pharmaceutical business wherever they are established. By exclusive prescription pharmacies and ethical pharmacies, I mean those whose businesses are confined respectively to the compounding and filling of prescriptions and to the selling, in addition, of other drug products, sickroom or physicians supplies and related products which serve the needs of human and animal health.

The pharmacy colleges now have an opportunity of further expanding their own and the pharmacy profession's influence, and their contribution to the industry as a whole by offering curricula which will enable pharmacy college graduates to practice and supervise wherever pharmaceutical knowledge is required. By so doing they can maintain increased enrollments without overcrowding and without making unattractive any branch of the pharmaceutical industry whether hospital, retailing, wholesaling, manufacturing, advertising or journalistic pharmacy.

A prerequisite of two years of academic college work is very necessary preparation for the study of pharmacy in its various professional areas, such as retail pharmacy, hospital pharmacy, hospital management, professional service pharmacy and sales promotion, pharmaceutical sales engineering, pharmaceutical journalism, pharmaceutical business administration, pharmaceutical market research, pharmaceutical chemistry and pharmaceutical engineering.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Pharmacy 3 years
Hospital Pharmacy 3 years
Pharmaceutical Chemistry 4 years
Hospital Pharmacy and Hospital Management 4 years
Pharmacy and Scientific Library Management 4 years
Pharmaceutical Engineering 4 years
Pharmacy and Business Administration 4 years
Pharmacy and Pharmaceutical Sales Promotion 4 years
Pharmacy and Market Research and Accounting 4 years
Pharmacy and Pharmaceutical Journalism 4 years

Every such curriculum in pharmacy should be so constituted as to qualify the graduate to become a registered pharmacist following the requisite amount of practical retail apprenticeship or interneship.

Pharmaceutical Engineering[3] as outlined in a suggested curriculum in an earlier article is a union of the curricula of pharmacy and chemical engineering, together with sufficient additional work in chemistry to qualify the pharmaceutical engineer for chemical or pharmaceutical research. Two years of prerequisite academic training, plus four years of professional college work should be required.

The pharmaceutical engineer who has served the necessary interneship to fulfill the requirement for registered pharmacist and has thus gained good, first hand knowledge of retail pharmaceutical operations and thinking, will be better qualified than others for the specialized technical positions such as engineer, research director, chief chemist, plant superintendent, production manager, production foreman, purchasing agent and other executive positions wherein a good knowledge of the sciences is necessary or at least desirable.

"Pharmaceutical manufacturers . . . . have become centers of scientific research as well as manufacturers of complex chemical and medicinal substances. They require highly and broadly trained scientists in more capacities than ever before. The chemist and chemical engineer are not nearly as well qualified to cope with pharmaceutical problems as are the pharmacist, pharmaceutical chemist or pharmaceutical engineer. On the other hand, the pharmacist does not have the engineering training necessary to handle many problems confronting the chemical engineer, yet both are graduates of four year college courses unless they have also pursued postgraduate study. Therefore pharmaceutical manufacturers are seeking individuals who are both pharmacist or pharmaceutical chemist and chemical engineer"[3]. Many universities such as Purdue (Indiana), Wisconsin, Minnesota, Maryland, Ohio, Iowa, Nebraska, Washington, California, Texas, Florida and Columbia can offer Pharmaceutical Engineering because

both pharmacy and chemical engineering courses are already offered. Other pharmacy colleges not so fortunately situated may make necessary arrangements with nearby engineering colleges to teach the required engineering subjects.

A pharmaceutical engineer, so trained, would obviously have a greater range of employment possibilities from which to choose, or to fall back upon in case of necessity, due to his greater versatility, inasmuch as he would have all the qualifications of a pharmacist, chemist and chemical engineer.

Purdue University has taken the lead among pharmacy colleges in encouraging students to combine pharmacy with chemical engineering subjects. Some, I am afraid, are apprehensive about suggesting "Pharmaceutical Engineering," as such, for fear the engineering college deans may be better salesmen and so get the course established under the direction of the engineering college with resultant loss of prestige for the pharmacy college. I am confident that will not happen if the initiative is taken by the pharmacy college heads and aggressively pursued, but if engineering college heads take the initiative, I think there is only one answer.

Interestingly enough, and a matter which might well be viewed with concern by pharmacy colleges and the pharmaceutical profession, only four weeks ago I received an unexpected letter from an engineering college asking my opinion of its serious contemplation of establishing a formal course in pharmaceutical engineering, although the graduates from its course would not qualify for registered pharmacist examinations. Will pharmacy educators delay action and permit engineering colleges to introduce "Pharmaceutical Engineering" to the educational field and the manufacturing branch of our industry as a formal division of engineering and so lay claim to its initiation and guidance, when many pharmacy colleges can most logically do so for their own prestige and welfare and in the best interests of a more closely knit, integrated pharmaceutical profession as a whole?

A curriculum in pharmaceutical engineering would undoubtedly influence students to matriculate in colleges of

pharmacy who would otherwise not do so and would thus be inclined to stimulate postgraduate work in other branches of pharmacy such as for the preparation of teaching. It would thereby raise the educational level and prestige of pharmacy as a whole.

The required subjects in the engineering portion of the curriculum cannot be given most effectively as postgraduate work after completion of the pharmacy course as presently constituted because of the courses prerequisite to more advanced subjects which are essential. The prerequisite courses must be pursued at an earlier time in the curriculum. For the same reason requirements of the pharmacy curriculum cannot be pursued most satisfactorily by the graduate chemical engineer.

An integrated, well planned curriculum in pharmaceutical engineering should be offered rather than the hit and miss selection of subects which might be worked into a postgraduate schedule following graduation in either pharmacy of chemical engineering.

It is recommended that colleges of pharmacy institute a pharmaceutical engineering curriculum so as to provide greatly needed pharmaceutically trained personnel for the manufacturing branch of the pharmaceutical industry.

Summary

It is suggested that colleges of pharmacy establish a two year college prerequisite to professional courses offered by them and to give students the advantages of subsequent selection of curricula in various branches of pharmaceutical education. It is especially recommended that pharmaceutical engineering be offered as a standard course for the benefit of the manufacturing branch of the industry as well as for the advantage that such a course of study would be to both the student who is so inclined and to the colleges of pharmacy themselves.

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(4) Product Sales Figures Obtained from *Drug Topics* Vol 90, No. 21 (October 14) 1946.

Pharmaceutical Engineering*

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We are met here today to discuss the need for a new profession. This profession is to be a wedding of the ancient profession of pharmacy and the modern profession of engineering. The ancient art of pharmacy has before spawned new sciences and new professions. From it came chemistry, and as a later off-shoot of the chemical sciences, chemical engineering.

It was early recognized, once chemical progress reached a volume which made it necessary to handle large units of equipment entailing difficult problems of heat and energy generation and transmission, together with corrosion problems of all kinds, that chemistry would have to unite itself with engineering in order that these problems might be solved by the combined sciences.

We have reached a similar point now in the development of pharmacy. Engineering techniques are being applied to

* An address given at the American Association for the Advancement of Science meeting, Boston, Massachusetts, December 28, 1946.

the pharmaceutical industry on a scale never conceived before. The development of penicillin during the war entailed the design of equipment of a magnitude never dreamed of in the history of the industry—equipment of a magnitude, indeed, so great that it compares in size with the great petroleum cracking plants. Not merely was this equipment large, but its design entailed problems of heat and air transmission never before experienced by the pharmaceutical industry. Likewise, it entailed problems of sterility, never before encountered on so vast a scale.

During the war, an industry hitherto regarded a batch of 100,000 ampoules as being a very large lot, was suddenly put to the necessity of producing ampoules in runs as large as ten and even twenty million of a single kind. These wartime developments added to the steadily increasing mechanization of the pharmaceutical industry, which began long before the war, emphasizes the acute need for pharmaceutical engineers.

The increase in large volume production and mechanized techniques, have brought into sharp focus the chronic complaint of the pharmaceutical industry that the pharmacy schools of this country are not turning out men qualified by training to work in pharmaceutical plants.

It may be wondered at this point, why the science of chemical engineering has not proved adequate for pharmaceutical operations. There are many reasons why chemical engineers have been found wanting. Because of improper training in most of the chemical engineering schools, many of the older chemical engineering graduates are not in reality chemical engineers at all, but are merely industrial chemists. Even in the schools, which do emphasize the engineering part of the chemical engineers' training, the general tendency is to focus chemical engineering training on the heavy chemical industry.

The chemical engineer knows much of the production of illuminating gas and coal by-products of various kinds. He

knows much of the production of heavy chemicals and is learned in thermo-dynamics. But he knows nothing of unit operations peculiar to the pharmaceutical industry; nothing of sterility techniques or of the biochemical or bacteriological processes which are characteristic of the pharmaceutical industry.

Another speaker has described some of the unit operations which are peculiar to the pharmaceutical industry. Ampouling is one which I believe has no counter-part in any other industry. Likewise, the production of bio-chemicals from animal glands and from living organisms has no counterpart. Likewise, the production of serums, vaccines and other bacteriological products is peculiar to the pharmaceutical industry.

Whereas, the chemical engineer is trained to be largely concerned with thermodynamic and corrosion problems, the pharmaceutical engineer is largely concerned with sterility and toxicity problems. He may on one day be confronted with the problem of handling liquid material in vast volumes in an asceptic manner as in the production of penicillin, and the next day be confronted with the problem of handling dry materials in large tonnages as in the production of alkaloids from botanical drugs. At another time, and perhaps in the same plant, he may be concerned with the production of potent powders and liquids which must be measured and handled with scrupulous care where any inaccuracy in procedures or technique might be fatal to the ultimate consumer.

The pharmaceutical engineer is interested in control procedures to a degree not to be encountered in any other industry. We are all familiar with the unfortunate occurrence wherein sulfathiazole and phenobarbitol were mixed in processing. This unfortunate occurrence was not by any means unique, and as the industry more and more turns to biochemical and synthetic organic chemical products, the development of more rigid failure-proof controls and procedures for intricate processes and products increases in importance by the hour.

The pharmaceutical engineer is concerned from a toxicity standpoint with the physiological effect of mixed preparations. You are all familiar with mysterious synergistic action wherein two non-toxic materials when mixed may become fatally toxic.

While the pharmaceutical engineer is never personally responsible for formulation and is never held responsible for possible toxic effects, he must comprehend the risks inherent in his work and the disasters that can come from carelessness or contaminations.

Throughout the country the pharmaceutical industry there is today, an acute need of well trained pharmaceutical engineers. But the industry is developing its own men because the pharmacy schools have apparently not yet realized that there is more to the profession of pharmacy than filling prescriptions and ice cream cones.

It is an extraordinary fact that in all the vast literature of pharmacy, there isn't a single exhaustive treatise on industrial scale pharmaceutical manufacture. In the pharmaceutical literature of the world, there are only two or three small monographs dealing with specialized phases of pharmaceutical manufacture on a large scale, and since one of these monographs was published in 1902, it is therefore, worthless.

With the exception of a few chapters in one book or another, all the literature of pharmacy is couched in retail terms and is focused on the problems of the retail pharmacist.

The simple fact is that the pharmacy schools have not kept abreast of the growth of the pharmaceutical profession. The profession has grown and expanded its horizons tremendously. This growth has been possible not because of the pharmacy schools, but in spite of them. It has been possible because pharmaceutical manufacturers have had to supply fundamental training which easily could have been provided by properly equipped schools. The industry has had to convert pharmacists and chemists as well as mechanical and chemical engineers into pharmaceutical engineers at very

considerable expense and with a great loss in time. The situation in respect to training in manufacturing scale pharmacy is so acute that one of the very large pharmaceutical manufacturers will not employ ordinary pharmacists at all. This company will employ only men having at least a bachelor's degree in chemisty or pharmaceutical chemistry from a recognized school, and thereafter it provides specialized training in accord with its own needs.

Pharmacy schools can help by providing courses in pharmaceutical engineering and by giving degrees in that profession. Because of this deficiency the pharmaceutical industry has been compelled to rely on "outside" professions for its supply of engineers and technicians as it has relied on other industries for most of its equipment. Those who operate plants know how difficult it is to adapt equipment which was originally developed for other industries, particularly when that equipment is to be used for the manufacture of products in which the highest degree of sterility must be maintained. And it is equally difficult to adapt men whose fundamental training and outlook are foreign to pharmacy.

I repeat, that a well rounded course in pharmaceutical engineering is an acute need of the industry. Granting this, then what should such a course include? In the *American Journal of Pharmaceutical Education*, Peterson*, on two occasions outlined the academic background for such a course. Let's not make such a course so academic. I should like to emphasize here what phases of that course are important from a manufacturer's point of view.

First of all, general engineering training as such must be intensive and comprehensive. The first three years of a pharmaceutical engineering course should be quite similar to a mechanical engineering course excepting that somewhat more emphasis should be placed on applied engineering. As I stated before, one of my complaints about chemical engineerings always has been that most chemical engineers are industrial chemists; — they're not really engineers because

* Peterson, A. F., "Pharmaceutical Engineering." Am. Jour. Pharm. Ed., Vol. IX, No. 2, 1945.

they have not been drilled sufficiently in engineering fundamentals. So in setting up our pharmaceutical engineering course, let us not repeat this mistake.

Aside from fundamental drill in basic engineering, there should be exhaustive study of the unit processes that are common to chemical and pharmaceutical engineering alike, and a still more exhaustive study of the unit processes that are peculiar to the pharmaceutical industry alone.

Next, there should be an intensive study of laboratory techniques. The amount of time wasted in pharmaceutical laboratories by chemists and pharmacists is simply appalling because they do not know laboratory techniques. They know none of the short cuts. They continue the academic techniques which they learned in the classroom. Engineering and work simplification can and should be applied to laboratory procedures.

Next, a pharmaceutical engineer must have a course in control procedures, by which I mean quality control procedures, beginning with the preparation of specifications and the checking of raw materials through all manufacturing processes to the finished product. If there is anything in which pharmaceutical engineering differs from chemical engineering, it is in the rigidity of control which must be applied to pharmaceutical products at all stages of manufacture. It is in this precisely that the viewpoint of the retail pharmacist and the manufacturing pharmacist differs. The retail pharmacist is not expected to assay every material he uses in compounding prescriptions. He goes by label statements. The manufacturing pharmacist, or pharmaceutical engineer, must assay everything.

Naturally of course, a pharmaceutical engineer must have a smattering of organic chemistry, bio-chemistry and bacteriology. All this added to a minimal academic requirement may sound like a large order, and there are those who feel that a pharmaceutical engineering course to be thorough should embrace a six year period. This would be desirable, but it may not be practical for most students. It is my theory

that an intensive course which is not loaded down with a lot of academic nonsense could be comprehended within the space of four years. During the recent war, the Army demonstrated that engineers can be trained in a period of as little as two years by concentrating on engineering and letting the "cultural" subjects go.

Now that we've given some consideration to what a course in pharmaceutical engineering should include, the next question is, how shall it be taught? Some years ago the speaker had a discussion about such a course with Dr. Fullerton Cook and also with Dr. Ballard of Columbia University, and it was then suggested that the proper way to give such a course is to organize the course as an actual factory is organized. Parenthetically it may be said that it would be ideal if some general pharmaceutical manufacturing plant could be constituted a university at which students could be taught while they are doing. If, however, such a course were organized as a manufacturing plant is organized complete with a president, sales manager, plant manager, and various department heads, the student, while he is learning pharmaceutical engineering would also acquire a basic knowledge of fundamental business organization, which he must learn anyway in order to qualify himself for a post in the industry.

When I made this suggestion originally, I pointed out that to implement the course it would be necessary to have a complete pharmaceutical manufacturing plant in miniature. The students would be required to manufacture the products and package them. They would be required to set up the control procedures, laboratory assays and to complete all the paper work and records that are necessary in manufacturing scale pharmacy.

I realize, however, that to establish a pharmaceutical engineering course on such a thorough basis might be far beyond the practical experience of pharmacy educators. But there is no question that an appeal to the industry would bring instantaneous support and cooperation, and it might even be that a pharmaceutical engineering course could be set up on a seminar basis in which the students would be required

to work in pharmaceutical plants a portion of each academic year. I have discussed this possibility with a number of my clients in the industry, and all are willing to cooperate—all are willing to give time to lecture students on practical aspects of pharmaceutical manufacture. As for myself, I should be glad to cooperate with any committee that pharmacy schools might set up to develop a practical and thorough pharmaceutical course.

It is to be hoped that pharmacy educators will fully realize the need for a thorough course in pharmaceutical engineering. Such a course will increase the stature of pharmacy educators and the importance of pharmacy as a professjon. It will forever allay the complaint of manufacturers that pharmacists are "nothing but soda-jerkers."

Engineering Problems of the Pharmaceutical Manufacturer*

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Industrial processes and methods of all kinds have changed and developed rapidly during the past six or seven decades, and any industry which expects to stay in business must, of necessity, not only keep pace with such developments but try to get two jumps ahead at all times. The pharmaceutical manufacturing industry was one of the first to apply machine methods to its production, but it has not kept pace with technological advances. There is still too much "coolie labor" involved in many of the processes and operations. The manufacturer will attempt to justify this on the grounds that many runs are too small for mechanization of the processes or buying equipment for a given operation. While there is an element of truth in these cases, a little study

* Read before the Pharmacy Subsection of the American Association for the Advancement of Science at the December 1946 meeting in Boston.

and ingenuity will show how equipment can be designed to serve multiple purposes. Too often the idea is to design the equipment to fit the process. In cases where a number of processes or operations do not justify individual mechanization, why not approach the problem from the other side and endeavor to fit the processes or operations to the equipment? It has to be done in part anyway, so why not go further? Moreover, the industry has long seemed satisfied with the equipment at hand instead of pushing ahead with ideas for machines of greater speed, higher degrees of accuracy, and generally more efficiency. Another thing that must be kept in mind, always, in the pharmaceutical manufacturing industry is that the processes and operations thereof are not merely overgrown drug store jobs. It is not, by any means, prescription filling on a magnified scale. To be sure, one might say it is prescription filling or drug store operations on a *large* scale, but let us consider the difference between magnified and large scale operations. Suppose we examine an operation on a magnified scale. A man is loading a small rowboat with sacks of grain. When we magnify it we see a larger boat, more men and more sacks of grain. The method is still the same: men toting sacks of grain aboard a vessel. Now let us look at the job being done on a large scale. We have a huge freighter, no sacks and very few men. The grain is run by gravity or blown into the ship's hold from the storage silos or bins. The end results in all cases are the same, viz., putting grain aboard a water-borne vessel, but the methods are different. In the pharmaceutical manufacturing business we must employ methods comparable to those of any industry handling large amounts of material.

Upon close, or even superficial, examination we find that the actual manufacture of a product is but a fraction of the entire pharmaceutical manufacturing procedure. Goods must be purchased and warehoused. Warehousing, properly done, constitutes a major job in this game. We have learned much during the war on the problems of systematic warehousing, how to move materials rapidly, stack them securely, and have them readily accessible for transmission to the processing and

operations area. These new and better methods involve not more but less labor. And this is only the beginning of the problems of material handling in the industry. Ask any pharmaceutical manufacturer what percentage of his total manufacturing cost is chargeable to material handling, and you are due for a shock unless you are already acquainted with the problem.

Another generous part of the entire picture is occupied by packaging operations. Relatively small amounts of pharmaceuticals are sold in bulk and therefore one might say that this industry is at least 50% a packaging industry. This phase of the pharmaceutical industry is essentially one of engineering. Many specialized pieces of machinery are used for the various operations, and not infrequently it is necessary to resort to a specially designed machine to do one particular operation. Much work of this type has been done in the pharmaceutical industry. Many intricate, cleverly designed, and efficient machines do marvelous jobs in the industry, and yet there is considerable room for improvement. A versatile, accurate, high-speed tablet counting and filling machine is sorely needed throughout the industry. Recently a concern offered, for $7500, a machine which would count and fill 60 bottles of 100 tablets per minute, but this at best is only 50% of the requirement. A machine of this type, to be modern and keep pace with other packaging machines on the line, must do 120 per minute. Many currently used machines, for both manufacturing and packaging, are obsolete and need either revision or complete replacement by newly designed machines operating on different principles. We now have an unlimited opportunity of making use of electronics, photo-electric phenomena, high frequency and dielectric heating, and other war-born developments which, with a little ingenuity, can be made to perform many useful tasks.

The question naturally arises as to how best tackle the many problems obviously confronting the man in charge of pharmaceutical production. It is at once apparent to anyone acquainted with pharmaceutical manufacturing and chemical engineering that the two fields have much in common. Pres-

ent education and training in either field alone do not prepare an individual adequately to be a progressive and successful pharmaceutical production man. Present training in pharmacy totally ignores the highly necessary training in engineering, whereas training in chemical engineering does not touch, even remotely, principles of pharmacy which are essential. Somewhere between the two lies the answer.

In studying the relationship between pharmacy and chemical engineering, let us first consider unit processes. In the early part of the century, chemical engineering was placed on a sound basis by classifying the chemical reactions involved into unit processes, and the physical methods into unit operations. If we study the unit processes of chemical engineering, we find a niche somewhere for practically every chemical reaction employed in the pharmaceutical industry. As a matter of fact, few pharmaceutical manufacturers in this country carry out extensive chemical processes. These are confined chiefly to the manufacture of items commonly known in the drug trade as "specialties," and the tonnage per annum of such items is relatively small compared to that of such drugs as aspirin, phenacetin, sulfas, etc., which are made almost entirely in the heavy chemicals industry. But those chemical processes which are used in the pharmaceutical industry may well be based on the principles already well known in the unit processes of chemical engineering. From a study of these processes we can always get the basic "know-how" with respect to equipment, conditions, methods, corrosion data, and other valuable information which can be applied directly to the chemical processes in pharmaceutical work whether the volumes be large or small. Hence, there is no need to discuss further this obviously close relationship between the two fields.

When we consider unit operations, we find also a close relationship, but in pharmaceutical work there are a few operations which might be considered as unique, or at least we do not find a close counterpart for them among the numerous unit operations of chemical engineering. As one example we have tablet and capsule coating. Perhaps the chem-

ical engineer would claim this under the unit operation of drying. Perhaps he would be right. Certainly, the coating operation is one which requires very careful and meticulous drying, but so many other factors are involved that coating could not possibly be included, in its entirety, under drying. The writer has come to regard it as one unit operation unique to pharmacy.

Tablet compressing is another operation which plays such a large part in the industry and has so many ramifications that it deserves a separate place in the classificaiton of unit operations. Granulation naturally follows with its bid for a special niche. This operation must not, of course, be confused with the chemical engineering operation of producing a chemical in granular form. The pharmaceutical operation is highly specialized in that it prepares one material or more generally a combination of materials in granular form for compression. The physical properties of the resulting tablets depend almost entirely on the methods and details of the granulating operation.

Emulsification is an operation common to pharmacy and chemical engineering, but in pharmaceutical work the materials, and frequently the nature of the product, are such that the operation requires special study from the pharmaceutical angle. Not infrequently, a unit process is involved and must be studied particularly with respect to its relationship to the unit operation.

If we regard the unit operations of chemical engineering as covering the physical manipulation of materials, we can consider other pharmaceutical manipulations as unit operations in the broadest sense of the term. This might easily carry into the packaging department and include such operations at tablet counting, filling containers with liquids, ointments, powders, tablets, capsules, and pills, hard-shell capsule filling, etc. One might argue that such operations have a strong leaning toward purely mechanical engineering but it is no more the case than the transport of fluids by pump, the movement of solids by screw conveyor, or the measurement

of liquids by proportionating pump, all of which are regarded as unit operations in chemical engineering. It is true that the mechanical engineers of the packaging machinery manufacturing companies have produced some marvelous pieces of equipment, but anyone who has dealt with pharmaceutical packaging cannot escape the strong feeling that every one of such machines can be vastly improved. The difficulty which blocks rapid progress in this direction is the lack of engineering training for the industrial pharmacist.

For all the exact and scientific training pressed into the modern graduate pharmacist, he becomes a victim of foolish ideas the moment he enters the manufacturing field. Two examples will serve to illustrate. Tablet coating is still regarded in the pharmaceutical manufacturing industry as an "art." No one can coat tablets properly until he has had long experience and training under someone else who has learned the art the hard way. Unfortunately there is too much truth in this at the present time, and all too often we find those skilled in the "art" extremely reluctant to impart their precious secrets to another. Such conditions in industry are intolerable and quite unnecessary. Tablet coating may be regarded as a unit operation and the various steps studied in a scientific manner. Accumulation of data in the development laboratory is the first step toward the standardization and control of the operation. The uncoated tablets must be classified according to physical, and to some extent chemical characteristics. According to these and the nature of the coating, we can determine the type of undercoat needed. The application of the main coat can be put under rigid control if the experimenter studies the coating material, the rate of evaporation of the solvent in relation to the rate of tumbling, the temperature and humidity of the air blown into the pan, rate of air flow,etc. Work along these lines has already yielded good results and there is no reason why it cannot be pushed to a logical conclusion.

Another completely neglected unit operation in the pharmaceutical industry is drying. The general practice is to

shove the material into an oven and let it stay there until it is "dry." About the only attention given the operation is to see that the temperature does not become so high as to damage the material. Here again, a working knowledge of drying as a unit operation is invaluable to the industrial pharmacist. He knows his material better than anyone else, but when it comes to taking out the moisture he either uses the old "hot-box" method or attempts to get reasonably good drying conditions by calling in a heating and ventilating engineer or someone who specializes in drying. This would be fine if the pharmacist could give the engineer all the data and information necessary to design the proper kind of drier. Generally he cannot. The cure lies in the experimental use of properly designed versatile driers in the development laboratory for the specific purpose of determining the optimum drying conditions. One this is done, a full-scale drier can be designed so that it will be capable of duplicating many sets of drying conditions. The industrial pharmacist would also do well to consider types of driers other than the conventional cabinet or oven into which the material is placed on trays and trucks. The material handling in this type of operation is a costly item because of the labor involved, especially when the operation is fairly large. Minimum operating costs are the only means of combating the steadily increasing labor and material costs.

In the foregoing, an endeavor has been made to show the strong desirability, if not the necessity, for the industrial pharmacist to have training in certain phases of engineering as well as in pharmacy. It has often been stated by many that the solution is to have the pharmacist and the chemical engineer work together, but the writer has never seen this work to the best advantage. Neither the pharmacist nor the engineer fully understands or appreciates the problems and the thinking of the other. The engineer regards the pharmacist as a bit balmy because of his exacting requirements and the attitude that "you can't do this and you can't do that." The pharmacist looks askance at the engineer who knows nothing

of the Pharmacopoeia, and regards him as a careless individual who gives not a hoot about high state of purity. But let either one delve long enough into the other's field, and they will quickly see eye to eye.

It is with this meeting of the pharmaceutical and chemical engineering minds as an objective that the writer advocates, and has advocated since 1941, a curriculum, in colleges of pharmacy, on pharmaceutical engineering or industrial pharmacy. The emphasis must be and continue to be on pharmacy because manufacturing pharmacy is still and always will be a practice of the ancient profession of compounding and putting into safe, convenient, and usable form the materials for preventing, alleviating and curing the ailments of the human body. The safety and efficacy of the final product is still of the greatest importance. Social and economic conditions are the guide-posts for every industrial enterprise, and these point to the necessity of producing the best possible product at the lowest possible cost. Competition demands that selling prices be kept as low as possible. This in turn demands the manufacturing costs be such that there is always a reasonable distance between the graphs of gross income and sales costs for the simple reason that when these two curves get too close together, no matter how large the volume may be, there are no profits, and volume without profit is business suicide. Therefore, the pharmacist must know the best engineering methods to apply in his plant if he is to be successful in the manufacturing field. He will find that a good, basic knowledge of chemical engineering fundamentals are essential, and he will quickly appreciate the necessity of applying principles of industrial engineering.

It is recommended that colleges of pharmacy, which are so located as to have available the facilities of good engineering schools, take advantage of the situation at the earliest opportunity and initiate a sound curriculum in pharmaceutical engineering for the specific purpose of preparing students to be the best qualified men for the pharmaceutical manufacturing industry. There is no question but that this type of graduate is sorely needed.

There is ample material and data on which such a curriculum can be based. Peterson's[1] suggested curriculum in pharmaceutical engineering is an excellent one and could serve as a pattern for any college of pharmacy in setting up the desired course of study.

[1] Peterson, Arthur F., Am. J. Phar. Ed., 9 176 (1945).

Pharmaceutical Education for the Future*

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You who are assembled here today are both the guardians and proprietors of a valuable segment of American Pharmacy. Let me propound to you, therefore, one of the most pertinent problems facing our profession.

What will be pharmacy's status in the public estimation of tomorrow? How will it be ranked as a member of the curative professions?

I believe the primary factor in the answer to these questions lies in the character and ability of the young men and women who will be attracted to our colleges and universities to study pharmacy. This in turn depends largely on the quality and extent of the education which we offer them when they come to undertake their studies.

That is to say, the content of the curriculum will determine, by selective process, the personal qualifications of the practitioners of pharmacy, and by so doing, it will ultimately govern the whole character of the pharmaceutical profession, industry, and business. Granting that, you must concede that no problem of greater moment is confronting pharmacy

*Read at the annual meeting of the New Hampshire Pharmaceutical Association, September 16, 1946, at Portsmouth.

in all its branches than the formulation of a comprehensive and forward-looking educational program.

Now, any revision of the curriculum for schools of pharmacy must rest on a foundation of sound conclusions derived from examination of all the facts about pharmacy's legitimate function that can be assembled. This calls for long and careful study.

The study to be made of American pharmacy in all of its ramifications by the American Council on Education will provide the facts necessary for weighing pharmacy's educational needs. The financing of this project by the American Foundation for Pharmaceutical Education is one of the outstanding contributions to pharmaceutical education of this or any other decade. Without this aid, the survey requested by the American Association of Colleges of Pharmacy would probably have been delayed for years.

Because of the large number of divisions and sub-divisions into which pharmaceutical effort is divided, it is highly desireable that during the next year or so a free discussion of pharmaceutical practice shall take place in order to clarify all of Pharmacy's future requirements. The new program that will come from this must be both inclusive and conclusive.

If a new plan of education is to be offered in the established institutions, it must meet certain conditions. In the first place, it must harmonize with general higher education, following the pattern developed through the years in our American colleges and universities. In the second place, it must be correlated with the programs in effect for professional education in the other healing arts, notably those in medicine and dentistry.

Whatever the conclusions reached by the fact-finding body, their recommendations, as I see it, will find expression through one of three channels. Here are the plans from which pharmacy will choose its training pattern for the future:

1. Continuation with the present four-year course leading to the Bachelor of Science degree. It would be expected that alter-

ations in the curriculum would be made from time to time in response to changes in practice.

2. Supplementing the present course with a greatly expanded graduate study program made available for those who wish to study for the master's or the doctor's degree. As in Plan 1, curricular additions and deletions might be expected in accordance with changing conditions.

3. Adoption of a pre-pharmacy college course, similar to that in use by medicine, followed by a professional course of four years leading to the degree of Doctor of Pharmacy. The pre-Pharmacy course would be given in a college of liberal arts and sciences and would be prerequisite for entry to a school or college of pharmacy. The four year professional curriculum would include. after two years of basic pharmaceutical education, the different terminal courses which would satisfy personnel requirements for each major division into which the practitioner's activities may be divided.

Let us examine now the reasoning that is offered in support of each of these three plans. The valid arguments for Plan 1, which calls in essence for retention of the present four-year curriculum, are not numerous. Higher education is on the march. There has been constant growth in the quality and quantity of medical and general scientific knowledge held by laymen as well as by the professional group. The cultural background of the general public has been expanded tremendously. It is therefore difficult to defend any proposition which would prevent the pharmacist's education, both general and professional, from keeping pace with these rapid advances.

The argument most often heard is that the possibilities of the present curriculum have not been exhausted and that we should not consider the adoption of any other progressive program until we have thoroughly explored the suitability of what we already have.

Perhaps it is true that we have not yet exhausted all the possibilities of the current basic curriculum. It is also true that medicine had not exhasted all the possibilities for the relief of human suffering through the educational plan in effect prior to adoption of the college pre-medical requirement. But medicine moved on to unexplored and richer fields as did

all of the professions with which we must correlate our activities. Must we alone continue to work our educational mine over and over again?

I should like to raise the question of how many years we ought to carry on this exploratory tour before deciding that further experimentation with the present curriculum is unwarranted. In 1932 the four-year curriculum to which students are admitted from high school was adopted and made effective by the American Association of Colleges of Pharmacy. Since then—for fourteen years, that is—a curriculum committee composed of carefully chosen educators and a national syllabus committee including representatives from education, licensure, and practice have labored diligently to produce a curriculum which would yield a satisfatory education with the few cultural subjects which could be squeezed in. After each curricular revision, the College Association asked the sixty-five colleges and schools of Pharmacy to try out the new schedules. They did so. Acting as guinea pigs, they yielded up their experience to implement committee findings.

Even this impressive effort of fourteen years does not tell our whole story of trial-and-error. Although the four-year program was made effective by the Association in 1932, an appreciable number of pioneering schools and colleges of pharmacy had for some years been offering such a course leading to the Bachelor of Science degree. In fact, the four-year curriculum of 1932 followed the pattern established by trial and demonstration in these schools during previous years.

Comparison of the curriculum item by item as recommended in 1932 and that recommended by the Syllabus of 1945, Tentative Fifth Edition Revised, shows few notable differences.

I submit that the present type of four-year program has had enough time to reveal and activate its potentialities. If after fourteen years of cerebration we have brought forth so little that is new, it is unreasonable to suppose that another

fourteen years of thought will give birth to a plan of surpassing excellence. Of course, it is quite possible to make a minor change every year. We can swing back and forth in the number of credit hours for a course like a creaking old weathervane as blasts of opinion point the arrow in one direction this year and in another the next. That may be change but it is not progress. If we explore for another fourteen years, we shall be, I predict, just where we are today.

Let us now look at Plan No. 2 Supplementing the present curriculum with an expanded graduate study program. It is a logical extension of our procedure today, if we must continue to enroll on high school credentials and grant the Bachelor's degree at the end of four years. Any important improvement in the program will of necessity be offered subsequently to graduation and chiefly on the graduate level.

Much may be said in favor of this plan, and its advocates advance plausible arguments for its adoption. Some of its leading proponents are those who have taught the basic sciences instead of some branch of the subject of pharmacy, either theory or practice. Having obtained their education in other than schools of pharmacy, they follow the pattern of the colleges of arts and sciences in their thinking and try to fit a professional course into the liberal arts design. They are joined in their basic thinking by many of those who would continue the present system and who are opposed to any change unless it be alteration within the present curriculum.

The only difference between this plan and the first that I discussed is that adequate provision would be made for offering advanced study to those who wanted it. Usually this means that the student prepared through graduate study for research in the chemistry, pharmacology and biological fields or, if in the manufacturing, for the general work of production which requires scientific knowledge. Plan No. 2 carries the implication that the pharmacist who practices in the neighborhood pharmacy, in the laboratory, hospital or medical center and in the government service is educated on a lower level and that he needs no better training.

I cannot assent to that assumption. More than that, I wish to point out the impracticability of the plan in general. To make the program effective would require a change in the undergraduate curriculum which I do not believe to be possible in the hours available. Few if any of the colleges of pharmacy employ a bachelor's curriculum which prepares the student on graduation for unqualified acceptance by the graduate schools of the better universities of the country. Additional undergraduate studies are usually required, the deficiencies varying in accordance with the major study selected. Most of the graduates of colleges of pharmacy who pursue such courses major in one of the chemistries, pharmacology, or other of the biological subjects. In general, they lack the required preparation in chemistry (physical and bio are good examples), anatomy, physiology, and mathematics. Deficiencies in English, German and French might be added.

In short, I do not believe it possible, without undergraduate study beyond the four-year course, to prepare a student for the practice of pharmacy and at the same time equip him to enter our better graduate schools for concentrations in the subjects I have mentioned.

Advocates of enrolling high school graduates for the four-year course ending in the bachelor's degree, followed by graduate study, argue that this is common procedure in the science field and point to chemistry, physics, bacteriology, and botany as common examples. The mistake they make is in failing to take into account the number of essential subjects with which the student must be familiar to qualify for the bachelor's degree in pharmacy. Pharmacy is not a science in the sense that chemistry is a science or physics is a science. A student working for a bachelor's degree in chemistry earns a large number of credit hours in his major subject and comparatively few in collateral science subjects. Therefore, he is prepared for advanced study in his field.

Pharmacy is a big umbrella covering a group of sciences which taken as a whole form not a science but a profession.

Every member of this group yields knowledge required for the practice of pharmacy according to the system which has been built up through the years. The hours required for instruction in these sciences must be provided in the schedule of classes. It is plain that the few hours remaining are not enough for those subjects which are required for entrance to the graduate schools. Plan No. 2 proposes to do something that can't be done.

The last of the three plans is the one which requires general education on the college level as pre-requisite to admission to a school of pharmacy. The pre-professional aspect of this program enables the school of pharmacy to divest its curriculum of most of the social studies and basic science courses now occupying so many hours in the standard course. They will be replaced, if the plan finds acceptance, by advanced subject matter which, properly chosen and emphasized, will yield an education for service in any department or branch of the broad field of pharmacy.

Before considering further the merits of this plan, let me call attention, as a matter of clarification, to a misnomer that has crept into discussions of changing our educational program. Certain of the proposed changes have been dubbed by some of our educators as "a five-year course in pharmacy." Such a label is unfortunate because it is misleading. To most pharmacists it suggests that four years are not enough in which to teach a student the essentials for the practice of pharmacy. For my part, I want to make it plain that I do not favor a "five-year course in pharmacy." We do not need more than four years of professional study. On the other hand, we cannot do the kind of job required for ultra-modern practice if we devote a substantial proportion of the four years of professional study to instruction in social studies and basic science courses. These are not professional studies, yet they are the essential undergirding of our professional studies.

That is why I am of the opinion that adoption of a program of pre-pharmacy college work is necessary if this pro-

fession is to advance in its long and halting journey toward real education for those who seek to cross its portals and receive its benefits. Some of us have always felt that pharmaceutical education would ultimately adopt this plan. Few realized how soon the need would become imperative. The impact of events has moved up the date. There has been a forward surge of higher education under the influence of Federal financial aid, especially to veterans. Nationwide prosperity has reached a magnitude that enables most families to send at least some of their sons and daughters to college.

This upsurge has carried pharmacy to opportunity's cross-road, and today is the day of decision. If it modernizes its educational program, pharmacy will be worthy of a place of honor among professions and it will have parity with the other old and established members of the public health group. If it fails to act now, it will contribute to its debasement to a sub-standard profession and a second-rate vocation.

Parity among the professions it not only a matter of comparable professional service. It also involves a common interest in and understanding of our social problems, the duties of citizenship, the fundamental structure of our government, and the means of maintaining its integrity. If one member of a professional group adopts a high standard of education for its members in the arts and humanities, equality does not exist until the other members reach a similar educational level. Professional status means identification with the highest values of society.

Pharmacy's lag is illustrated by the fact that when medicine first required two years of college education for entry to a school of medicine, pharmacy enrolled on a high school education. When pharmacy went on a four-year basis it introduced some cultural subjects in the expanded curriculum, but even so, the gap between the educational programs of these two health bodies has been steadily widening. A very small percentage of students entering medical schools are accepted with the minimum requirement of two years of college

education. The average for all students is about 8.6 years. Dentistry also requires at least two years of college work as a pre-requisite for enrollment.

As a member of the healing arts group, the pharmacist must of necessity labor constantly with the physician and dentist to effect their common purpose—prevention and cure of disease. This association can meet with full fruition only if the professions enjoy common educational standards in the arts and sciences as well as in professional training.

The pharmacist's measure as a professional man is also taken by the nature of his relationship to his public and the attitude toward him expressed by that public. His relationship with the men and women who visit his pharmacy is constant and intimate. A recently published survey showed that 5.5 percent of the women questioned visited a pharmacy daily and at least 35.4 percent went there once a week. These astounding percentages indicate the strategic position occupied by the pharmacist for the dissemination of knowledge and constructively influencing public opinion.

Fifty or sixty years ago the pharmacist was outstanding as a man of influence in his community. This was largely due to the circumstances that for that period he was a person of advanced education. With knowledge that labeled him as a superior person, his opinions were sought, and they were received with confidence and respect. Since that time, although the number of pharmacists in America has not materially changed, their relative standing in the community has not improved in proportion to their additional professional education. The reason for this is the rapid spread of college education through all ranks of the population.

The United States Statistical Abstract based on the 1940 U. S. Census, contains a table that indicates clearly the importance of the general educational program that I advocate if we are not to see the gap between pharmacists of the future and their public clientele grow wider and wider.

POPULATION—U. S.

1890	1900	1910	1920	1930	1940
62,947,714	75,994,575	91,972,266	105,710,620	122,775,046	131,669,275

Total enrollment in Institutions of higher education.

1890	1900	1910	1920	1930	1940
170,487	237,592	355,215	597,880	1,100,737	1,493,203

Total graduated

1890	1900	1910	1920	1930	1940
14,306	25,324	34,178	48,622	122,484	186,500

These figures tell the story of education's growth. While the population was doubling, the number of college graduates multiplied thirteen times. The number of students enrolled in the colleges and universities rose from 355,000 in 1910 to almost a million and a half in 1940. Fifty years ago the total enrollment was only 170,000. The estimated enrollment for 1946 is more than 3,000,000.

In other words, America has forged ahead faster than the American pharmacist. That is the reason why the man who fills the doctor's prescriptions is no longer so urgently besought to give his own prescriptions for problems of the home, the nation, and the general welfare. Perhaps it is just as well. That was a characteristic of a simpler age that is beyond recall. Today I plead for a program which will yield parity. We cannot hope for the old superiority. Even so, the American pharmacy is still one of the country's great social institutions as well as indispensable member of the healing arts. The human personality that dominates it will be content to relegate to the past his position as an oracle if he can retain the esteem of his community for his professional wisdom, educational breadth, and personal integrity. These are the qualities of character and training for which you who are practitioners and we who are educators have joint responsibility for providing to American pharmacy.

Gentlemen, I am pleading for education for the Pharmacist of the future to be placed on as high a level as that of the average college educated American citizen. Suddenly, under governmental auspices, and unparalleled economic op-

portunities, over night we will multiply the number of Americans equipped with varying degrees of higher education. Consequently in the future our young people will be forced to our colleges and universities to successfully meet the established intellectual competition, not just for advancement to great heights, but to earn a decent living.

If we base our education on plan one or two, or on any variation which admits students from high school to our professional course, we will freeze their cultural education, their education for citizenship on the present level. We hold a grave responsibility. Let us discharge it by having the courage to plan the pharmacist's general education for the future in harmony with ever changing social, political and economic progress.

Achievement and Predictive Testing in the Pharmaceutical Survey[1]

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and
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1. *Introduction*

Notwithstanding the importance of the pharmacist—of his selection, training and professional functioning—the inadequacy of the present utilization by the profession of available scientific knowledge concerning personnel problems is generally recognized by those technically competent to pass judgment. Personnel techniques available well before World War II and, of course, greatly developed during the war, have been extensively applied in other educational, industrial and military areas. They have been applied, however, only spor-

[1] This paper is an adaptation of Document 5 (Mimeographed, The Pharmaceutical Survey, American Council on Education, Washington, D.C., 1946).

adically and institutionwise in pharmacy—at least if the paucity of published technical literature is any indication. Even on the basis of this individual-institution application the available methodology has been shown to result in a marked improvement over what preceded the use of such methodology. This observation may be documented in such areas of education as medicine, general education, and engineering. Selection and classification of military personnel have, of course, given an object demonstration on a scale immensely more vast than would have been possible in education anywhere.

The possibilities and limitations of personnel technology applied to pharmaceutical education are well shown in a recent study.[2] This study may be considered to have exhausted the possibilities of predicting success in pharmaceutical education using the traditional criterion—semester marks. Although in terms of a single institution, these results are probably typical in the sense that similar results would probably be obtained at other institutions were such a study to be repeated in them. This traditional criterion of grades has severe limitations in that it lacks uniformity and standardization—in a word, in that it is highly unreliable. This unreliability is bound to restrict prediction to that possible with coefficients of multiple correlation of between .5 and .7. A similar range of values has been found a good many times in other attempts to predict semester marks in such areas as general education, engineering and medicine.

To be sure, if these results were generally applied in pharmaceutical education, this would constitute a very genuine improvement over what now exists. It is, however, possible to improve prediction very appreciably over these figures by improving the measures of success which are used as a criterion.

Both the statistical logic through which improved prediction will result from increased reliability of criterion measures

[2] Moore, Marjorie E. "The Evaluation of Certain Factors for Predicting the Success of Students Entering the College of Pharmacy of the University of Minnesota from 1933 through 1943," Journal of Experimental Education, March, 1946, pp. 197-224.

and such studies as that by Williamson and Bordin[3] give warrant for anticipating measurably increased efficiency of prediction. In the latter study, for example, this increase was from .67 using the traditional criteria to .86 using a battery of achievement tests. In terms of improved forecasting efficiency this means raising the accuracy of prediction to about twice that traditionally realized. Granted the high money cost to the individual and society of pharmaceutical training, and, even more importantly, the crucial importance of the pharmacist's role in medical service, such improvement of predictive efficiency would represent a human engineering achievement of tremendous significance.

II. Purpose of the Study.

The purpose of this paper is to outline a program and its rationale for the implementation and application of the best available techniques for the selection, guidance and evaluation of prospective pharmacists. In the light of what has been said above it is evident that, to conform to the logic of the problem and to the ideal chronology of its implementation, the first unit study with which The Pharmaceutical Survey should be concerned in this group is "Methods for the Measurement and Comparison of Student Achievement and Progress." Accomplishment of this unit study will provide the criterion to be used in developing or selecting the measures for the selection, admission, and guidance of pharmacy students. Some compromise with this program is necessary in order to conform with the preconceived time limits for The Pharmaceutical Survey. If the measures of success with standardized tests are obtained at the end of four years of pharmaceutical training for students who will have entered in September, 1947, and who will have been tested with possible predictive measures at that time, then the validity of the program as here proposed can not be determined until the end of the school year 1950-1951. In so far as such a schedule goes beyond what is allowed by a predetermined schedule for the

[3] Williamson, E. G., and Bordin, E. S. "Prediction and Success in the College of Science, Literature and the Arts," **University of Minnesota Studies in Predicting Scholastic Achievement, Part 1, College of Science, Literature and the Arts,** The University of Minnesota Press, Minneapolis, 1942, p. 27.

entire survey, compromises in the form of concurrent attacks on both criterion and predictive problems will be made. This will involve validation of predictive measures against criteria less adequate than those eventually to be used.

III. Improvement of Criterion Measures.

The possibility of improving criteria of success may next be considered. It must be recognized at the outset that possible criterion measures must hinge upon the results of a considerable number of other unit studies being undertaken by The Pharmaceutical Survey. Among these are at least the following:

"UST 4 (X) Summarization of prior (and current) studies of pharmaceutical education, and their effects upon the training of professional personnel for pharmacy.

"UST 8 (7) Statistical study as to the supply of and the demand for various forms of trained personnel in the field of pharmacy.

"UST 9 (X) Assembly of material relative to Pharmaceutical Industry Research Laboratories, with special reference to (a) needs for trained Pharmacy personnel and (b) possibility of the development of cooperative research activities with Colleges of Pharmacy. (See UST 37).

"UST 31 (X) Examination and valuation of the Pharmaceutical Syllabus.

"UST 32 (1) Spot analysis of present-day prescriptions to determine the knowledge required in compounding them.

"UST 33 (3) An analysis of the general knowledge that a pharmacist should have regarding pharmaceutical products as indicated by information requested by members of the medical profession and questions asked by customers.

"UST 34 (4) A study of the new fields of pharmaceutical service with their implications both for training and for employment. Need for diversification and specialization of training.

"UST 35 (8) The impacts of business and industry upon pharmacy—and the resulting need for the integration of practical duties and pharmaceutical education.

"UST 37 (12) Graduate levels of professional and educational preparation required in pharmaceutical service. (See UST 9).

"UST 41 (2) A study of the activities engaged in by selected groups of pharmacists—professional, commercial, civic, etc.

"UST 42 (6) An evaluation by pharmacy graduates of their previous training in relation to the activities in which they engage.

"UST 44 (X) Field study of the working conditions of representative groups of pharmacists.

"UST 51 (5) A study of the role of Pharmacy in medical care.

"UST 52 (X) A study of the relation of Pharmacy to Veterinary medicine and practices.

"UST 53 (X) Relation of Pharmacy to Nursing.

"UST 61 (13) The relationship of the requirements for licenses to the programs in pharmaceutical education; evaluation of State Board Examinations.[4]

"UST 62 (X) Food and Drug Laws and regulations. Impacts upon instruction and practices."

A reading of the titles of these unit studies readily suggests that they will bear heavily upon the construction of more adequate measures of achievement.

Prior to the completion of these unit studies, however, it will be possible to make substantial first approximations on the basis of present curricula and courses of study in schools of pharmacy. As revisions of these courses of study and curricula become available in the light of the unit studies listed above, and as The Survey's resources make possible, the criterion measures, i.e., the comprehensive achievement examinations, can be improved.

A brief summary outline of the rationale of achievement measurement is in point here. The following steps are entailed:

1. Obtain agreed-upon statements of objectives of training from the pharmaceutical profession—the Pharmaceutical Syllabus, courses of study, textbooks, judgments of subject matter experts, judgments of practising pharmacists, state board examinations, "job analysis," materials of the U. S. Employment Service, analyses of the National Roster of Scientific and Specialized Personnel, "Ohio State and Occupations" (pages 131-134), etc.

[4] A paper on State Boards of Pharmacy Examinations is being planned for a subsequent number of this **Journal.**

2. Weight the objectives—prepare a table of specification showing the weights to be assigned to each general and specific objective in evaluating the student's achievement.

3. Assemble examination situations (items) to elicit responses (paper-and-pencil or performance) showing relative presence or absence of achievement of each objective.

4. Construct preliminary forms of tests containing more items than will be required in the final forms of the tests.

5. Obtain criticisms of the preliminary form by experts in the subject matter of the tests and by experts in test technology.

6. Administer the preliminary forms of the tests to representative samples of pharmacy students at the appropriate levels of training.

7. Analyze the test results statistically—e.g., obtain group measures and indices of item validity and difficulty.[5]

8. Make the final selection of items to be retained.

9. Standardize procedures for administration, scoring, establishing norms, interpreting results, and for safeguarding certain materials.

Two obvious characteristics of the results of such a program would in themselves insure substantial increases in the reliability of criterion measures. In the first place, such tests would be objectively scorable. Secondly, national standardization would make for uniformity in the application and interpretation of measurements by means of the measuring devices. Under this program measuring devices will be made available to the pharmacy profession that will make possible the improved prediction previously mentioned.

IV. The Construction of Predictive Measures.

Concerning measures predictive of achievement it may be restated here that in terms of presently available criterion measures the possibility of prediction has been demonstrated to be fairly good. Multiple correlations of .50 or better have been attained with the present predictors and criteria. The guidance and social implications of this are that prediction can be substantially better than a sheer guess and that ex-

[5] Cf. as an illustration of the detailed processing of achievement tests, Remmers, H. H., and Davenport, K. S., **Objective Testing at the University Level**, mimeographed, Purdue University, Division of Educational Reference, 1944.

cellent tools for student selection and guidance programs are already at hand.

The selection and construction of predictive devices will probably not present anything like the difficulties inherent in the construction of the criterion measures. Published studies of batteries of tests used to predict scholastic success at schools of pharmacy, medicine, engineering, and in other curricula document this proposition.

One promising lead that goes beyond most previous attempts along these lines will be explored in the present study. This is the possibility of improving prediction by means of measures of relatively non-intellective characteristics of students.[6]

Briefly stated, the rationale for the development of predictive devices is as follows:

1. Establish a criterion of success to be predicted.
   a. Qualitative criteria
      1. Success-failure
      2. Graduation-elimination
   b. Quantitative criteria
      1. Grade-point index
      2. Scores on a battery of achievement tests
2. Invent, select, or adapt test items considered possibly predictive of success.
   a. On the basis of expert judgment
   b. On the basis of past experience and research
3. Administer the proposed predictive devices experimentally to a sample of students for whom maximally valid criterion data will be available.
4. Analyze the results of the predictive measures statistically.
   a. By means of multiple-regression techniques using total scores on the predictive measures.
   b. By means of item analyses to determine the validity of individual test items and to make possible elimination of non-predictive items.

[6] See Detchen, Lily, "The Effect of a Measure of Interest Factors on the Prediction of performance in a College Social Sciences Comprehensive Examination." **Journal of Educational Psychology**, January, 1946, pp. 45-52.

5. Administer the improved battery of predictive measures to a fresh sample of pharmacy students for whom criterion measures will be available.
6. Express the results of step 5 in statistical form.
   a. In terms of multiple regression equations
   b. In terms of probability tables that will enable selection and guidance officers of schools of pharmacy to perform their functions in the light of the improved measuring instruments.
7. Standardize the procedures for administering, scoring, and interpreting the predictive measures.

V. Guidance Implications.

Provisions for guidance already implicit in the preceding paragraphs merit brief additional discussion here. In addition to the application of predictive measures and the probability tables they will yield, mention should be made of the need for adjustment of "cut-off" scores in terms of the social-professional demands of pharmacy practice on the one hand and of the available supply of students on the other. Furthermore, "differential guidance" within the pharmacy curriculum and among types of pharmacy careers will be necessary and will necessarily be based upon the application of the procedures already outlined. It is likely that different types of ability and training will be required for practitioners of pharmacy in retail establishments, hospitals, industrial organizations, research laboratories, etc. Different combinations and weightings of scores on the predictive measures will, it is anticipated, make the prediction of and guidance for these specialities a further result to be anticipated.

VI. Proposed Experimental Procedure

At this point at least a rough estimate is desirable in quantitative form of the scope of the study proposed. The population sample should, of course, be generally representative of pharmacy students and of schools of pharmacy in the United States. Practical necessity, however, will require that all students in a given school of pharmacy be included in the experiment. The sampling of schools should, therefore, be widely distributed geographically, since quality of pharma-

ceutical instruction may presumably be a function of such geographical distribution.

In order to insure maximum stability of the results, the size of the sample of students should, of course, be as large as the resources of the study make possible. A reasonable minimum of numbers of students and schools are 500 to 1,000 and 12 to 25, respectively. The figures for students refer, of course, to the annual requirements of the study. It must not be overlooked also that there is need to provide for probable shrinkages in the number of students who will complete the entire experimental program.

With respect to the schedule of examinations it is planned that comprehensive achievement examinations be constructed and administered at least at the end of the senior year when there would be a final comprehensive examination based on the course work of the junior and senior years, the preceding two years, and over such objectives as are indicated by other unit studies. It is not anticipated that such a comprehensive final examination will be ready before the spring of 1948.

Because of the relatively advanced state of research on predictive measures it has been possible for an experimental battery of such measures to be selected and administered to freshmen during the fall of 1946.[7]

The kinds of characteristics measured in this battery include general scholastic ability; mathematics training including arithmetic; language abilities—mechanics of written English, vocabulary, reading; science background; interests; and biographical data.

VII. Personnel and Functions.

To implement this program, a technical advisory committee has been formed consisting of consultants in educational measurement and of appropriate representatives of the pharmaceutical profession. The members of this committee are as follows:

[7] A description of the Predictive Testing Program of The Pharmaceutical Survey appears in the present issue of this Journal.

Dean B. V. Christensen, College of Pharmacy, Ohio State University.
Dr. H. A. Edgerton, Director, Occupational Opportunities Services, Ohio State University.
Dr. T. R. McConnell, Associate Dean, College of Science, Literature, and the Arts, University of Minnesota.
Professor C. V. Netz, College of Pharmacy, University of Minnesota.
Dr. H. H. Remmers, Chairman, Student Personnel Studies, Director, Division of Educational Reference, Purdue University.
Dean E. R. Serles, College of Pharmacy, University of Illinois.
Dr. R. W. Tyler, Division of the Social Sciences, University of Chicago.

Initial tasks of such a committee have been to study and make recommendations with respect to the following:

1. Determining the amount of time to be allowed for the comprehensive criterion examination. It is obvious that compromises between scientific ideals and available time will be necessary at this point and will perforce shape the implementation of the entire program.

2. Recommending optimal arrangements for liaison in order to capitalize to the fullest possible extent upon the results of other pertinent unit studies.

3. Enlisting members of pharmacy faculties to construct tests for all courses to be represented in the comprehensive criterion examination. It has been desirable to distribute this work among representatives of several schools of pharmacy with some overlap among them as to their responsibilities for subject-matter tests. The following committees have been appointed:

Pharmaceutical Chemistry
L. M. Parks, University of Wisconsin, Chairman
J. F. Oneto, University of California
Walter H. Hartung, University of Maryland

Pharmacognosy
E. H. Wirth, University of Illinois, Chairman
Marin S. Dunn, Philadelphia College of Pharmacy & Science
A. H. Musick, University of Tennessee

Pharmacology
L. D. Edwards, Purdue University, Chairman
H. B. Haag, Medical College of Virginia
Paul Mattis, University of Florida

Pharmacy
C. V. Netz, University of Minnesota, Chairman
Allen I. White, Washington State College
E. P. Guth, Ohio State University

The following chart gives a concise picture of the functions and personnel of the studies of student personnel.

ORGANIZATION OF FUNCTIONS AND PERSONNEL FOR EXECUTION OF GROUP B STUDIES

Overall Direction of The Pharmaceutical Survey
Dr. Edward C. Elliott
Liaison to obtain results of other unit studies
Direction of Group B Studies
Technical Advisory Committee: Three educational measurement experts and appropriate pharmacists
Unit Study 13: Criterion measures
Development of objectives, tables of specifications, test items
Three educational measurement experts, one test technician, curricular experts
Unit Study 11: Predictive measures
Editing, printing, distributing of Test Materials
Test technician, clerks
Unit Study 12: Guidance procedures
Statistical analyses and reports of Test Results
Three educational measurement experts, test technician, clerks

The Predictive Testing Program of the Pharmaceutical Survey

H. H. REMMERS, Director
and
N. L. GAGE, Test Technician
Student Personnel Studies, The Pharmaceutical Survey, Purdue University

Early in 1946, the American Council on Education was requested by the American Association of Colleges of Pharmacy to undertake a survey of pharmacy and pharmaceutical services. Responding to this request, the Council undertook to carry out The Survey and appointed Dr. Edward C. Elliott as its Director. Approximately $100,000 has been provided for The Survey by the American Foundation for Pharmaceutical Education.

In the preliminary schedule of unit studies to be undertaken by The Survey was a group of studies entitled "Students—Quality, Quantity, and Qualification." Included in this group of studies were the following titles:

UST (11) Criteria for the Selection and Admission of Pharmacy Students.

UST (12) Provisions for Guidance of Pharmacy Students.

UST (13) Development of Special Aptitude and Achievement Tests; Comparison of Student Achievement and Progress.

UST (14) Place and Future of Women in Pharmacy.

It was apparent that adequate implementation of these studies would necessitate the co-operation of specialists in the field of educational measurement and guidance. Acting upon this need, Dr. Elliott secured from the senior author a memorandum the substance of which has been presented in another paper in this Journal.[1] The program outlined in this memorandum was accepted and H. H. Remmers was appointed

[1] **Remmers, H. H., and Gage, N. L.** "Achievement and Predictive Testing in The Pharmaceutical Survey," **American Journal of Pharmaceutical Education,** January 1947, pp. 43-53.

as Director of the Student Personnel Studies to be undertaken in executing it. A technical advisory committee was also appointed consisting of Professor Harold Edgerton, Director, Occupational Opportunities Service, The Ohio State University; Dean T. R. McConnell, College of Science, Literature and the Arts, University of Minnesota; Professor Ralph W. Tyler, Division of the Social Sciences, University of Chicago; Professor C. V. Netz, College of Pharmacy, University of Minnesota; Dean E. R. Serles, College of Pharmacy, University of Illinois; and Dr. H. H. Remmers, Chairman, Student Personnel Studies, Director, Division of Educational Reference, Purdue University. In July, 1946, Dr. Elliott, Dr. Remmers and the advisory committee met at Chicago to make plans for the program of predictive testing to be carried out beginning with the fall semester of 1946.

As a result of this meeting, a battery of predictive tests was agreed upon and plans were made for execution of the program on a nation-wide basis. On July 10, 1946, a letter was sent by Director Elliott to the deans of accredited colleges of pharmacy throughout the United States, inviting them to participate in the proposed program for the measurement of the quality of entering freshmen at the beginning of the academic year 1946-1947.

It is the purpose of this paper to outline the rationale of the program of predictive testing, to describe its operation, and to indicate the course which it should take in the future.

The Program of Predictive Testing

The rationale of predictive testing consists in brief of, first, the development or selection of a set of behavioral situations considered on the basis of past experience or psychological "insight" to be prognostic of success in specified tasks; second, the administration of a set of tests that elicit these behaviors from a sample of persons who will eventually undertake the tasks in which success is to be predicted—in this case, freshman pharmacy students; and, third, the validation of the tests in terms of correlations between performance in

the test situation and measures of success in the task or undertaking that is considered as the criterion. These tests are briefly described below in reverse order. In the case of the predictive testing program of The Pharmaceutical Survey, the ultimate criterion is "success as a pharmacist" with all that such a phrase implies. In the absence of available measures of this ultimate criterion, substitutes may be used in the form of measures of success during and at the end of pharmacy training. To provide such criteria, comprehensive senior examinations in pharmacy are now being developed. For the second step, it was apparent that the freshman entering schools of pharmacy should be given upon their entrance into training the set of tests considered, largely on an *a priori* basis, to be predictive of success. That this could readily be done was soon apparent from the responses of the deans of the colleges of pharmacy to Dr. Elliott's invitation to participate. The following 55 colleges of pharmacy agreed to participate in the Fall of 1946 testing program:

ALABAMA
Alabama Polytechnic Institute
Howard College

CALIFORNIA
University of California
University of Southern California

COLORADO
University of Colorado

CONNECTICUT
University of Connecticut

DISTRICT OF COLUMBIA
George Washington University
Howard University

FLORIDA
University of Florida

GEORGIA
University of Georgia

ILLINOIS
University of Illinois

INDIANA
Purdue University
Butler University

KANSAS
University of Kansas

KENTUCKY
Louisville College

LOUISIANA
Loyola University
Xavier University

MARYLAND
University of Maryland

MASSACHUSETTS
Massachusetts College of Pharmacy

MICHIGAN
Ferris Institute
Detroit Institute
Wayne University

MINNESOTA
University of Minnesota

MISSISSIPPI
University of Mississippi

MISSOURI
St. Louis College of Pharmacy, Allied Sciences
University of Kansas City

MONTANA
Montana State University

NEBRASKA
Creighton University
University of Nebraska

NEW JERSEY
Rutgers University

NEW YORK
Fordham University
Union University
Columbia University
Long Island University
University of Buffalo

NORTH CAROLNIA
University of North Carolina

NORTH DAKOTA
North Dakota Agricultural College

OHIO
Western Reserve University
Ohio State University
Cincinnati College of Pharmacy

OKLAHOMA
University of Oklahoma

OREGON
Oregon State College

PENNSYLVANIA
Philadelphia College of Pharmacy and Science
University of Pittsburgh
Duquesne University

SOUTH CAROLINA
Medical College of the State of South Carolina
University of South Carolina

SOUTH DAKOTA
South Dakota State College

VIRGINIA
Medical College of Virginia

WASHINGTON
University of Washington
State College of Washington

WEST VIRGINIA
University of West Virginia

WISCONSIN
University of Wisconsin

NEW MEXICO
University of New Mexico

PUERTO RICO
University of Puerto Rico

The first step in the logic of the program entailed problems whose solutions were somewhat less clearcut. In view of the short notice upon which the program was being launched, it was apparent that only already available and well

developed tests could be used. In the light of a vast accumulation of findings in other types of academic prediction, such as those in liberal arts, engineering and medical curricula, it was possible to base the selection of measuring instruments upon fairly strong hypotheses concerning the nature of the abilities correlated with success in pharmacy training. Furthermore, since it was intended that comparisons should be possible between freshmen entering schools of pharmacy and freshmen entering other curricula in institutions of higher education, at least some of the tests should have norms based upon such non-pharmacy freshmen. That the tests should be thoroughly standardized as to administration and completely objective in scoring was necessary to insure the comparability of scores as between the various colleges of pharmacy. To enable exploration of the possibility of improving prediction through measures of non-intellective aspects of students, such as interest, preferences and temperament, it was desirable that at least a sample of the pharmacy freshmen be given a test of such traits.

In the light of these considerations, the following battery of tests was selected for use in the Fall 1946 Predictive Testing Program:

1. **American Council on Education Psychological Examination for College Freshmen. 1946 Edition.** This is a general scholastic ability test whose previous editions have been found to predict freshmen college grades about as well as is possible with any single available test. It measures speed and accuracy in the solution of problems involving words, numbers, and diagrams. In addition to a total score, it yields two relatively uncorrelated sub-scores, "Q" or "quantitative" and "L" or "linguistic." It is anticipated that norms for this test will be available on the basis of tens of thousands of college freshmen entering hundreds of other institutions of higher education in the fall of 1946. By means of these norms, it will be possible to compare pharmacy freshmen with students entering non-pharmacy curricula in colleges throughout the nation.

2. **Cooperative English Test, Form PM.** This test measures, in a form probably somewhat more affected by previous school experience, the student's achievement in English usage (grammar and diction, punctuation, capitalization, sentence structure), spelling and vocabu-

lary. Nation-wide norms are available for this test so that pharmacy freshmen can be compared with other groups of students.

3. **Purdue Physical Science Test, Form AM.** This test has been found to predict substantially the actievement of high school students and college freshmen in courses in physics and chemistry. It deals with basic mathematics (operations and problem analysis) and scientific judgment (vocabulary, facts, experience and interpretation). Norms for this test are not available on an extensive nation-wide basis.

4. **Purdue Mathematics Training Test, Form XM.** This is a test to determine mastery of the fundamentals of arithmetic and algebra. It has been found in a small sample of students (N=62) to be the single test most highly predictive of freshman grades in the school of pharmacy at Purdue University. Its relatively high emphasis on arithmetic was considered to make it uniquely suitable for the prediction of success in pharmacy training. Norms for this test are also available only on a local rather than a national basis.

5. **The Kuder Preference Record, Form BM.** This test obtains a systematic and quantitative record of preferences for nine distinct types of activities: mechanical persuasive, computational, artistic, literary, musical, scientific, social service and clerical. This test was given to only about 1,000 of the pharmacy freshmen entering a randomly selected group of colleges of pharmacy. Norms for this test are available for high school students, college students, men and women, and adults engaged in various occupations. It is hoped that the non-intellective measures obtained with this test, in combination with the scores for the other tests, will improve the predictive value of the battery. It may also prove to be possible through the use of these interest scores to develop procedures for the guidance of pharmacy students among the various types of pharmaceutical occupations, such as research, retail services, pharmaceutical supplies salesmanship, etc.

6. **Pharmacy Background and Personal Data Blank.** The first, or personal data, section consists of a set of questions dealing with home background, work experience, community and high school extracurricular activities and socio-economic status. The second section consists of questions requiring the application of knowledge that may have been acquired from experience as an apprentice in a drug store or elsewhere. It is intended to provide a measure of information and, indirectly, interest in pharmacy. This section was adapted from the Pharmacy Aptitude Test of the University of Illinois College of Pharmacy. It is intended that each of the questions in the first section be correlated individually with the criterion and that the total score and individual questions for the second section be similarly correlated. No norms are available for this test.

The Program in Operation.

During July and August, 1946, detailed plans for the execution of the program were made. A detailed manual of directions to examiners was prepared for the guidance of the staff members who were to administer the tests in each of the participating colleges of pharmacy. Test booklets, answer sheets, and special pencils were packaged and shipped to the 55 participating institutions from the central office of the Student Personnel Studies, located in the Division of Educational Reference at Purdue University. During September and October the tests were administered according to the standardized directions to approximately 4,500 freshmen entering schools of pharmacy. At the present writing almost all of the test materials have been returned to the central office and scoring and statistical analysis of the results are well under way. Rosters of the "raw" scores of individual students are being sent to the respective institutions as test results are received and promptly processed. More adequate interpretation of these scores and comparisons of average scores among individual institutions, different sections or regions of the nation, between men and women, and between pharmacy freshmen and non-pharmacy freshmen will be made in a comprehensive report on the results on the testing program to be submitted both to the Director of The Survey and to the deans of the participating colleges of pharmacy. Code numbers will be used to preserve the anonymity of the participating institutions. Tables showing the number of students who attained various scores on each of the tests will be prepared as well as charts showing graphically the averages and variabilities of the scores. In short, it will be possible for the first time in pharmaceutical education to secure a comprehensive, objective, quantitative and scientifically relevant description of the quality and qualifications of the freshmen entering schools of pharmacy in the United States in a given year.

The Future of the Program.

The full meaning of the test scores will not be known until the tested freshmen emerge from their training as

seniors about to be graduated and licensed. At that time an investigation will, it is hoped, be made of the relationship between the scores on their predictive tests taken four years earlier and their performance on comprehensive examinations designed to measure the attainment of the objectives of pharmaceutical education. It is apparent then that far from the full value of the predictive testing program will be realized from the forthcoming preliminary report. Rather there is need for a systemic followup and study of the freshmen tested this fall. To insure adequate masses of data for continued validation studies, the battery of predictive tests should be administered to new classes of freshmen. To explore the possibilities of tests other than those included in this battery, substitutions should be made in the light of expert judgment and preliminary findings. A continuing mechanism is necessary, similar to those developed by the medical and dental professions, so that the program for the selection and guidance of the best available personnel may be continued, expanded and improved.

The Present Status of Graduate Education in Pharmacy*

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I am pleased to have this opportunity to express some views on this important problem of graduate instruction in pharmacy. This conference marks the first of its type in the A.A.C.P. in that it allows time for an expression and exchange of views in regard to graduate instruction, irrespective of the various fields of pharmacy involved.

* Presented at a Special Teachers' Conference on Graduate Instruction at the 1946 meeting at Pittsburgh.

This opportunity has not heretofore been available and as a result the interest in graduate instruction has not been what it should be. One of the important methods of creating interest and maintaining that interest in a specific topic is to establish opportunity for discussion and exchange of ideas. If for no other reason, it is my firm belief that this Special Teachers' Conference on Graduate Instruction should be continued in order to provide the necessary opportunities for discussion and for the creation of interest in graduate work in general.

The development of superior graduate instruction in the various fields of pharmacy *must be* stimulated, not only because there is a great shortage of men with advanced training in these fields but because the prestige of pharmacy as a profession demands it. The American Association of Colleges of Pharmacy has more or less allowed each member school to shift for itself in solving problems related to graduate instruction. No concerted effort has been made to better the profession as a whole through the extension of graduate education.

Because of the last war, the public is keenly aware of the connection between scientific research and its social consequences, and is greatly concerned about it. The prestige of a profession will depend now, more than ever before upon the scientific achievements of that profession. By what better means can we expect to increase the prestige of our profession than by the development of a few basic scientific discoveries connected with the name pharmacy? The effect of such basic discoveries upon allied professions has been demonstrated recently in the fields of chemistry and physics. The only way that we can expect to bring about scientific achievement in pharmacy is through the improvement of the scientific aspects, which originate with graduate instruction.

Progress in the scientific areas of pharmacy can only be assured if we have an ever-widening basis for well trained scientific personnel. It is true that in scientific research that work on a broader scale brings about quicker and better de-

velopment, and that is exactly what is needed in the various branches of pharmacy.

Research is good for its own sake, it is the purest intellectual pleasure that is known; but from the standpoint of the profession, we must consider the value to pharmacy as a whole, not just the pleasure it gives to a few scientists who happen to be interested of their own initiative.

We must see to it that our schools of pharmacy provide and stimulate opportunities for more scientists to be trained in our profession. We must deviate a fair share of our educational facilities and resources to scientific research, not an excessive share, but one that will produce substantial results.

In the universities a model research worker has to perform at least three functions, namely, actual research, teaching, and research direction. It seems to be generally agreed that the functions of research and teaching can be combined with advantage. In general, it may be said that if a man carries on both functions at the same time they react favorably on each other. His research work is the better for his teaching activities, and his teaching is all the better for his participation in research. In *all* of our schools of pharmacy at present, it is very probable that too much time is spent on teaching activities alone—and it is very difficult to see how this situation can be improved unless our university staffs are largely increased. If this is what is necessary, then we should not hesitate to do all in our power to correct this situation by increasing staffs and thereby allotting more time for research to those qualified. At the present time an increase in staff facilities in our schools of pharmacy is very difficult, many schools not being able to obtain a minimum qualified staff for undergraduate teaching. This deplorable situation occurs as a result of the lack of interest in graduate instruction—the lack of interest in the scientific aspects of pharmacy.

One of our prime objectives in this profession should be the education and training of research personnel to the highest possible level, both in quality and quantity. In my opinion

there is nothing that will aid the profession more, and on study of the problem one is easily convinced, that research personnel on the highest level is absolutely necessary in view of the keen competition of our allied professions.

We need to insure that the maximum possible number of exceptionally gifted individuals are made interested and qualified for work in the pharmaceutical science. We need those who will work on specific problems and those who are capable of inspiring and leading other research workers. Selection of such a group is a comparatively easy matter. They select themselves. One cannot keep the first-class research worker down, but one can see that he rises more quickly and that he comes up in the right place. The right places as far as we are concerned are the various branches of the pharmaceutical sciences.

In addition to this special group we should educate a large group capable of pursuing, under direction with intellectual integrity, investigations that would form a large share of the important worthwhile research.

It is entirely impossible for a school to train these men in all the aspects of research. The universities can expect only to lay the foundation on which the student can build. after which the most important educational factor is that of providing the student insofar as possible with a proper research attitude, instilled with confidence and research spirit.

It is desirable to present a brief resumé of the present status of graduate instruction in schools of pharmacy and to point out the apparent trend that is taking place in this field.

The data presented here was compiled from questionnaires returned from forty-five deans of the member colleges of pharmacy. Fifteen of the member colleges did not respond to the questionnaire; however, with the exception of one or two cases, those colleges that did not respond probably do not offer graduate instruction and do not intend to do so within the next five years.

As was pointed out in the report of the Committee on Graduate Study in Pharmacy, twenty-four schools of the forty-five reporting offer graduate instruction leading to the advanced degrees. Of the remaining schools which do not at present offer graduate instruction, *none* intend within the next five years to offer graduate instruction leading to the Ph.D. degree and only four of these schools intend to initiate graduate programs leading to a master's degree in one or more of the four major fields.

This data is of interest because recently there has been expressed some fear that the establishment of so-called graduate instruction programs in schools that are not qualified to offer work of this type will occur. It has been felt that some of the financially weak schools of pharmacy have contemplated taking advantage of the remuneration obtainable from graduate students if they were allowed to enter these schools. If this should happen great harm to the profession would, of course, occur. However, the data indicates that the trend in this direction is not great and that the growth of graduate instruction is confined primarily to those schools which already have established graduate programs in one or more of the major fields of pharmacy.

The number of schools offering graduate instruction leading to advanced degrees in the four major fields are summarized briefly as follows:

		Major Field		
Degree	Pharmacy	Pharmaceutical Chemistry	Pharmacology	Pharmacognosy
Ph. D	7	11	6	8
Master's	20	23	15	14

Only five schools of pharmacy offer graduate instruction leading to both the Ph.D. and the Master's degree in all four of the major fields of pharmacy.

The number of schools which intend, within the next five years, to initiate graduate instruction leading to advanced degrees are summarized as follows:

Degree	Major Field: Pharmacy	Pharmaceutical Chemistry	Pharmacology	Pharmacognosy
Ph.D.	6	4	4	2
Master's	6	2	2	3

All but four of these schools already have established graduate instruction programs in one or more of the major fields.

The trend as indicated is for those schools that already offer graduate instructional programs in one or more of the four major fields to broaden their present facilities to include one or more of the remaining major fields rather than for schools that have no graduate instruction at present to initiate entirely new programs. This can be considered a good trend and should be encouraged.

The number of students working toward advanced degrees in the field of pharmacy is of considerable interest. The data is summarized according to the various types of appointments on which the students are maintained:

Number of Graduate Students in Pharmacy.

Type of Appointment	Number As of June 1946	Expected Number As of Sept. 1946
Assistantship	38	72
Fellowship	36	62
G. I. Benefit	27	37
Scholarship	14	17
Self Financed	14	10
Foreign Govt. Sponsored	3	2
Total Number	132	200

The total number of graduate students in schools of pharmacy in June 1946 was about 132, and the expected number of graduate students as of September 1946 is about 200, an increase of about seventy students for the fall terms.

The total number of graduate students that schools of pharmacy offering courses toward advanced degrees will be

able to accommodate as of September 1946 is 265. This is only about 60 more students than are expected to register in these schools this fall.

The estimated number of graduate students that schools of pharmacy will be able to accomodate five years hence in 1951 is 480, almost double the present accomodations.

This is a step in the right direction but we must be sure that the graduate standards are maintained at a high level and that we stimulate interest in graduate instruction and the scientific areas of pharmacy to such an extent that the scientific achievements will stand out along with the scientific achievements of our allied professions.

Graduate Education in Pharmacy*

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Graduate education in pharmacy is nothing new but we hear more and more talk of its importance. We hear many educators, heretofore not especially interested in establishing graduate divisions in their colleges, talk about giving work leading to the Master of Science and the Doctor of Philosophy degrees. This is understandable in view of the large demand for persons with these advanced degrees. The colleges of pharmacy are hard pressed to employ teachers who meet the requirements of this area. Pharmaceutical companies are engaged in a terrific race to establish research departments manned with capable personnel. There just doesn't exist enough people to meet the demand. This being the case, it is no mystery why more colleges are beginning to talk about setting up a graduate division. This is a laudable spirit and we must commend those educators on their ambition. However, any college that has given graduate work knows that it

* Read before the Conference of Teachers on Graduate Instruction at the 1946 meeting at Pittsburgh.

is not possible to develop a graduate department by resolution alone.

A sound graduate program must be built on a sound and high quality undergraduate program. This means a well-balanced curriculum, a well-trained faculty, adequate physical facilities, and the access to other academic departments which are also capable of giving instruction on the graduate level. One man on a staff does not make a graduate department. In order to have a graduate division, a college should have at least three well-qualified staff members. One in pharmacy, one in pharmaceutical chemistry, and one in pharmacology and pharmacognosy. In addition, time must be available for these men to direct research and give advanced courses. Regardless of the qualities of an individual, he can not be expected to carry a full undergraduate teaching load and do a job in graduate instruction. Likewise, the equipment and physical facilities that are usually adequate for undergraduate instruction are found wanting in graduate education. A graduate student must have space and special equipment to carry out research projects in a satisfactory manner.

A large modern library is an absolute essential. And lastly, the standard for admission of a student to graduate study and the quality of work expected of him must be held to high levels.

Assuming that these requirements are met, the next step is to outline programs of instruction. There are at least three types of programs that are in demand. There is a demand for persons with a kind of training that will enable him to do research and direct others. This usually requires one with a Ph.D. degree. Then, there is a demand for persons who can do research work under direction—this requires a M.S. degree. Also, there is a demand for persons with specialized training beyond that of the B. S. degree. Such a person may be specialized in pharmaceutical chemistry, manufacturing pharmacy, drug plant cultivation, hospital pharmacy, *etc.* The Ph.D. and the M.S. are essentially research degrees, requiring the satisfactory completion of an original research problem. This

type of study requires a keen and challenging type of mind on the part of the student. The profession is in dire need of a great number of this type of individual and the place to start looking for them is in the undergraduate classes. It seems quite probable that many more graduate students could be had if proper vigilance was maintained over the under classmen. An outstanding student can be encouraged to do extra work and to think about graduate training. If he is interested, then it is the responsibility of the college to give him every opportunity to develop. This can be accomplished by setting up minor problem courses in each of the subdivisions in pharmacy. These problems should be limited and within the ability of the student to handle but they should not be just routine. They should be designed to stimulate the student's interest. This type of course has been tried with considerable success in interesting students to do graduate work.

The exact nature of a graduate program may vary depending on the student's ability and the condition existing at each college but it seems to me that every graduate program in the pharmacy colleges should be designed to give a student a broad training in pharmacy as well as a specialty. A pharmaceutical chemist should have an appreciation of pharmacology, pharmacognosy and pharmacy. Likewise, the man who wishes to be a pharmacist must know the place of pharmaceutical chemistry, pharmacognosy, and pharmacology. Pharmaceutical chemistry, pharmacognosy, pharmacology, and pharmacy make up the whole field known as pharmacy. These must be coordinated to become really effective in graduate training. Every graduate student, regardless of his field of specialization, should take work in each of the four subdivisions before he embarks all out on his field of choice. This plan gives him a clearer insight as to the importance of his field to profession as a whole. This also calls for coordination of effort among the various faculty members handling the graduate program and should bring forth a wealth of knowledge. Each department should have organized classes where the level of instruction is on a high level and with the major burden placed on the student. In addition, special problem

courses can be set up, designed to start the student on a research program. All of this should be coordinated with cognate courses offered by other departments at the university.

A M.S. degree may be awarded at the end of one year, or two years of satisfactory work but it doesn't seem possible for a student to really get the feel of research at the end of one year of study. The first year is usually taken up in getting the student oriented to graduate study and not much in the way of original research can be expected. It would seem advisable to establish a one year graduate program devoted entirely to course and special problem work. A degree could be awarded on successful completion of such a course but it would not be a research degree. It would be a terminal degree and designed to give training in some specialty for other than research endeavor. A two year M.S. degree gives a student a much better opportunity to develop his research ability. A Ph.D. program would be an extension of the two years M.S. program and a more finished product would be produced. The profession needs more men with graduate degrees but the emphasis must be placed on quality rather than quantity and therefore, the quality of students admitted to graduate education must be held to high levels. The student must have demonstrated his ability to do a high quality of work and he must have a proper background. The principal weakness of the graduate schools is the large number of weak undergraduate curricula in the colleges of pharmacy. Many young men have been lost to the graduate division because they had the unfortunate experience of having to attend a school of pharmacy with a weak curriculum or faculty or both. When these students apply to colleges offering graduate work, they usually find that they must take a considerable amount of undergraduate work before they can get under way in their graduate program. The undergraduate curricula must be strengthened in basic sciences and at the same time be made more flexible not only for the development of graduate students but for those who wish to engage in the regular practice of pharmacy.

Graduate Instruction in Pharmaceutical Chemistry*

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For the purpose of this paper pharmaceutical chemistry may be definied as that branch of chemistry predominantly concerned with the development, manufacture and control of effective diagnostic and therapeutic agents. This broad field of endeavor is also commonly referred to under the descriptive title of "medicinal chemistry."

Since pharmaceutical chemistry deals primarily with agents designed for use on living organisms it goes without saying that those preparing for work in this field should be given a broad background in both the biological and physical sciences. Indeed, pharmaceutical chemistry represents, in part, a fusion of certain of the biological and physical sciences. Although the pharmaceutical chemist is first of all a chemist he must also have a working knowledge of biology.

In the past the importance of the biological sciences has not always been recognized but it is the training in the biological sciences that can and should distinquish the pharmaceutical chemist of the future from the non-pharmaceutically trained chemist. We agree with Hartung[1] that the pharmaceutical chemist must have a "broad and sound training in all the fundamentals of chemistry" but we feel that the time has come to evaluate "those intangible and unassessable qualities" that come from long experience with medicinals and pharmaceuticals. If fundamental training in chemistry plus long experience with pharmaceuticals were all that could be offered the graduate student there would be little point in setting up a graduate program in pharmaceutical chemistry. It would be much easier to advise qualified pharmacists to work for the Ph.D. degree in chemistry. While such a pro-

* Read before the Conference of Teachers in Graduate Instruction at the 1946 meeting at Pittsburgh.

gram would be vastly superior to a program in pharmaceutical chemistry that neglects fundamental chemistry, there is little doubt that it would leave to the biologist and clinician the responsibility for directing the work of pharmaceutical chemists. This is a wasteful procedure as compared to an educational program that aims at providing scientists who are able simultaneously to evaluate the chemical and biological factors in a problem. It seems obvious to us that an understanding and working knowledge of the fundamental properties of living cells and organisms are desirable if not essential for the rational development of chemical compounds designed for a specific pharmacological use. The physio-chemical properties of the cells where action occurs is a consideration of no less importance than the physio-chemical properties of the drug.

It might be argued that it is neither practical or feasible to train an individual in both the biological and physical sciences. This, we believe, is not true providing the scope of the training in the biological sciences is pointed toward the fundamental principles of biology rather than the commonly accepted detail required of majors in the field. It should be understood that the pharmaceutical chemist is not expected to encroach on the biological fields but rather to make use of his knowledge of biology in order that he may work more effectively and independently in his field.

The following outline is based upon our own experience in designing a program for graduate instruction along the lines suggested in the foregoing paragraphs.

A. General qualifications of graduate students for work in pharmaceutical chemistry.

1. Superior scholarship.
2. Adequate undergraduate training in chemistry, mathematics and the biological sciences. The latter should include zoology, physiology, anatomy, and biochemistry.
3. Ability and interest in research.

B. Specific course prerequisites. (A few of these courses may be taken during the first year of graduate study.)

1. Theoretical and analytical chemistry through elementary physical chemistry.

2. Organic chemistry through modern theories of valence, structure, etc.
3. Pharmaceutical chemistry including the chemistry of natural products, drug assay, synthetic drugs and the synthesis of organic medicinals.
4. A reading knowledge of two foreign languages. (To be satisfied by examination during the first year of graduate work.)
5. A working knowledge of mathematics through elementary calculus.
6. Introductory courses in physiology and biochemistry as offered at the undergraduate level.

C. Qualifications of the Faculty Member responsible for graduate instruction.

1. He should enjoy the full confidence of his colleagues.
2. He should have those qualities of leadership and scholarship that will enable him to direct the graduate student into productive research. These qualities usually can be evaluated from the number and quality of his published works.
3. The faculty of a college offering graduate instruction must be "strong" in the sense that its members are recognized for their contributions in their respective fields. It is most difficult to evaluate the adequacy of an individual instructor without regard to the faculty of which he is a part. A well qualified instructor is not likely to do his best as a member of a "weak" faculty, whereas an active research group can be depended upon to stimulate the interest of graduate students.

D. Physical facilities for graduate instruction.

1. The institution offering graduate instruction should have, in addition to these facilities required for sound undergraduate instruction, laboratory space that can be assigned to graduate students for research. The laboratories must be provided with all essential equipment necessary for competent work. Graduate students should not be expected to work on research problems with equipment that is inferior to equipment commonly used by other recognized workers in the field. Certain general facilities such as a well equipped shop, glass blowing equipment, well stocked storeroom and all of the common tools for analytical and physical chemistry are essential.
2. Graduate instruction should be offered only by those institutions maintaining adequate library facilities.

E.—Typical program of study.

At the University of California the following programs are established for the Master's degree and the Ph.D. degree in Pharmaceutical Chemistry.[2] In order to be accepted for graduate work

in pharmaceutical chemistry, the student must, in addition to having satisfied the general requirements for admission to the graduate school, have completed the following courses or equivalent thereof with distinction: Advanced Organic Chemistry (3 units), Elementary Physical Chemistry (4 units), Chemistry of Natural Products (4 units), Chemistry of Synthetic Drugs (3 units), Synthesis of Organic Medicinals (3 units), Pharmacology and Toxicology (3 units), Biochemistry (4 units), Medical Bacteriology (5 units), together with the prerequisites thereto.

Master's Degree

The work leading to the Master's degree in Pharmaceutical Chemistry consists of 24 semester units of upper division and graduate courses, of which at least 12 units must be graduate courses in pharmaceutical chemistry. The minimum upper division requirements may be fulfilled by completion of the following or equivalent: (1) Reading knowledge of German or other acceptable foreign language. (2) Advanced Synthesis of Organic Medicinals (3 units), Organic Analysis (4 units), Seminar in Pharmaceutical Chemistry (0 units), and 6 units chosen from the following courses: New Synthetic Processes of Organic Chemistry (3 units), Mechanism of Organic Reactions (3 units), Advanced Theory of Organic Chemistry (3 units), Assay of Drugs (3 units), Food and Drug Analysis (3 units). The required 12 units of graduate instruction usually takes the form of special study involving a research problem under the direction of a member of the faculty.

Ph.D. Degree

As a background for specialization in the field of pharmaceutical chemistry, students who desire to become candidates for the Ph.D. degree in pharmaceutical chemistry must satisfy the following courses or the equivalent thereof in addition to a selected group of courses acceptable as the minimum required for the Master's degree: (1) Reading knowledge of German and one other acceptable foreign language. (2) Elementary Calculus (6 units), Biochemistry of Enzyme Action (3 units), Mechanism of Organic Chemistry (3 units) or Type Reactions of Organic Chemistry (3 Units), Advance Theory of Organic Chemistry (3 units), Pharmacology Laboratory (1 unit), Pharmacology Lecture (3 units), Physiology (6 units), Seminar in Pharmaceutical Chemistry.

For the purpose of passing the qualifying examinations for advancement to candidacy for the Ph.D. degree, the student will be held responsible for such additional subjects as the executive committee on Pharmaceutical Chemistry may designate as part of the student's preparation.

Candidates for the Ph.D. degree must possess a broad and thorough knowledge of those subjects that constitute a proper background to the general field of pharmaceutical chemistry. The passing of the designated courses does not necessarily assure that the background is adequate. The student must acquaint himself with the recent advances of the subject by reading current literature. To that end the language and course requirements should be satisfied as soon as possible. Students must pass the examinations in foreign language before making application for the qualifying examinations. After the candidate for the Ph.D. degree has passed his qualifying examinations, he is required to complete a research program leading to an acceptable thesis. The nature of the thesis and its quality is determined by a committee composed of qualified members of the faculty. Success or failure of the graduate program is largely dependent on the good judgment of the Thesis Committee and the committee responsible for the qualifying examinations.

F. How instruction at the graduate level may be improved.

1. By attracting better students.
2. Improving physical facilities.
3. Attracting and holding men eminently qualified for teaching in the field.
4. Elimination of excessive teaching loads and other routine duties of members of the staff responsible for graduate instruction.

G. Opportunities for pharmaceutical chemists.

It should be remembered that pharmaceutical chemistry as outlined here is largely for the future. The universities and schools have only comparatively recently established sound educational programs for graduate instruction in the field and several years will be required for development.

The holding of a degree in any field of learning does not assure the individual a successful career. However, the opportunities in pharmaceutical chemistry are virtually unlimited for those who are fundamentally trained and well qualified in the field. It is the duty of those responsible for graduate programs in pharmaceutical chemistry to see to it that those individuals who are certified as competent pharmaceutical chemists shall actually possess the necessary qualifications to serve in responsible positions that now too often remain unfilled. If the universities and colleges responsible for graduate training of pharmaceutical chemists of the future do not fail their students, successful careers in pharmaceutical chemistry can be assured.

Summary

The pharmaceutical chemist must first of all qualify as a competent chemist, but in addition he should possess a working knowledge of biology sufficient to enable him simultaneously to evaluate the chemical and biological factors in a problem. The general qualifications of graduate students in pharmaceutical chemistry are outlined together with comments on the physical facilities and teaching staff required for graduate work in other branches of chemistry. However, a listing of specific course prerequisites shows that in addition to basic training in chemistry, physics and mathematics that compares favorably with the basic requirements demanded by the better schools of chemistry, the student must present evidence of accomplishment in the biological sciences and in undergraduate courses in pharmaceutical chemistry.

The programs for the Masters degree and the Ph.D. degree in pharmaceutical chemistry at the University of California are outlined. Although the possession of an advanced degree in any field of endeavor is in itself no assurance of a successful career, pharmaceutical chemistry provides excellent opportunities for those who are well qualified in the field.

Acknowledgement

The authors acknowledge with thanks the cooperation of their colleagues who have assisted in the planning of a graduate program in pharmaceutical chemistry.

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Graduate Work in Pharmacognosy*

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1. *Qualifications of Candidate.*

The desirable qualifications of a candidate for graduate work in pharmacognosy as well as in any other graduate field depends first of all on his ability, his aspirations and possibility from a more or less personal viewpoint.

It is believed that there are a number of qualities which have proven useful and should be considered in this appraisal of the graduate student's qualifications. These are as follows:

Achievements in Undergraduate Work
Knowledge of the Subject
Intellectual Curiosity
Natural Curiosity
Native Ability
Professional Interest
Attitude
Personal Determination
Honesty
Accuracy
Dependability
Organization
Judgment
Self-reliance and Confidence
Sense of Proportion and Humor
Self-respect
Courtesy
Personality
Appearance
Force of Character
Intellectual Maturity
Vigor—Health

Only those students should be accepted who show a reasonably high rating in the above factors.

The student should have preferably graduated from a school of pharmacy in which the curriculum was flexible

* Read before the Conference of Teachers in Graduate Instruction at the 1946 meeting in Pittsburgh.

enough to have allowed him to elect several courses in pharmacognosy and therefore has had the privilege of taking a major interest in the subject during his undergraduate training.

2. *Specific Course Prerequisites.*

Specific courses prerequisite to the graduate study in pharmacognosy should include the usual curriculum in pharmacy including mathematics, physics, general inorganic chemistry, quantitative and qualitative analysis, organic chemistry, and the biological sciences including botany, zoology, beginning pharmacognosy, physiology, bacteriology and pharmacology.

It is highly desirable that the student has taken elective courses or specialized courses or a survey course or courses which include plant physiology, plant pathology, plant genetics, taxonomy, ecology, soils, entomology, advanced bacteriology, plant parasitology, plant chemistry and the microscopy of foods and other plant products.

3. *Qualifications of Professor.*

It is equally important that the professor responsible for graduate instruction meets the same personal qualifications as already outlined for the student. He should be at all times an example to the student, show a marked personal interest in each graduate and his problem, and take special pride in the achievement of his students. In his direction of research, the professor should be especially cognizant of an honest interpretation of results. Toward the student it is important to be a friend and an advisor. He should be diplomatic and capable of meeting the public on the layman's level. Extra-curricular activities tend to enlarge the scope of his information. Travel and the making of new contacts with the view of obtaining the latest information in the field of pharmacognosy, which, when imparted to the student, will be a valuable asset. The professor should never be satisfied with routine teaching

methods and his abilities should be directed to the best advantage of the student.

It is understood that the professor responsible for graduate instruction is, by past experience and research, fully qualified in all of the specialized branches of his subject.

4. *Physical Plant and Scientific Equipment.*

The physical plant and scientific equipment for competent work depends largely upon the nature of the graduate program. A well rounded graduate program in pharmacognosy should include facilities for both field and laboratory work with opportunities to do highly specialized work in either.

The usual microscopical equipment including research microscopes, petrographic microscopes, microtomes, cytological equipment, equipment for photomicrography, the customary chemical equipment for plant chemistry including such specialized items as a potentiometer, photolemeter, vacuum oven, centrifuges, refrigerator, and equipment for solvent extraction and recovery of volatile oils should all be included in the equipment of the laboratory. When new methods and equipment are devised these should be included as it is essential that the student be trained in the methods and handling of equipment as used in modern industry.

Sufficient land should be available for field work. This land should preferably be of variable nature allowing space for the usual type of horticultural plot work and for special studies on plant growth where conditions of natural shade are essential. Other variable conditions are also advantageous. Equipment should include the usual farm machinery as might be necessary in certain problems. The plant analysis laboratory can be utilized for the analysis of soils. Special thought should be given to equipment in the harvesting of the crops and also to facilities for the drying and storage of the harvested material.

5. *A Recommended Typical Program of Study.*

Any recommended program depends upon whether the student intends to specialize in field or laboratory work. Formal graduate courses should include work in plant physiology, genetics, taxonomy, anatomy, cytology, plant pathology and ecology. Additional courses such as horticulture, soils, entomology and insecticides, mycology and fungicides, plant chemistry and plant analysis, an advanced course in microscopy of plant products and plant constituents, a course in advanced pharmacology and drug assay and a study of the economics of drug production and commerce should also be included in the program of study.

6. *Improvement of Instruction at Graduate Level.*

The improvement of instruction in pharmacognosy at the graduate level depends largely on three fundamental factors: (1) sufficient space and equipment; (2) sufficient staff (the professor should not be required to give instruction in all of the subjects); (3) financial support. When cognizance is given to these three general factors, which are now so definitely lacking, many of the specific deficiencies will disappear.

7. *Opportunities.*

Opportunities for persons majoring in this field are already considerable and will increase when it is recognized that persons with specialized knowledge are essential. At present he may plan to become a teacher or a research specialist in an industrial laboratory or in a research institution, or a pharmacognosist in governmental inspection of foods and drugs, or a specialist in the cultivation and production of drugs. The lack of men trained in this latter specialty was drastically felt during the past war emergency.

The efficiency of graduate as well as undergraduate instruction in pharmacognosy will advance as rapidly as colleges of pharmacy recognize the importance of this field and their neglect of it in the past.

Graduate Work in Pharmacology*

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Introduction

I wish to express my appreciation for being invited to speak to you about Graduate Work in Pharmacology. I also wish to ask that you please bear with me in two respects. The time allotted will allow me only to mention certain phases that may need further elaboration; secondly, as a consequence, more stress is placed on certain aspects with which I am more familiar.

General Qualifications of Students Entering Graduate Work in Pharmacology

The general ability of the graduate student entering the field of pharmacology is, to a large extent, shown by his scholastic record, which should be an index of his intelligence, memory, industry and, to a lesser extent, his health. With suitable examinations, it is possible to measure his resourcefulness and ability to apply the knowledge he has acquired. However, even if his scholastic record and performance in special examinations are excellent, additional information concerning certain of his attributes of character and temperament is required to determine whether he is likely to succeed in the pursuit of graduate work in pharmacology.

The student must realize that many systematic studies in pharmacology require tedious repetition of experiments and daily drug administration over considerable periods of time. This demands a high degree of dependability, perseverance, accuracy and cheerfulness. It frequently demands more hours of work than those in an ordinary work week. The student should understand that he is really working for himself and that there is no time clock to be punched. Is he then willing to work evenings and even holidays with a smile? Frequently,

* Read before the Teacher's Conference for Graduate Instruction at the 1946 meeting at Pittsburgh.

projects demand collaboration and cooperation with other students or the teacher. Punctuality is of prime importance here. The acceptance of voluntary assistance from fellow-students carries with it the obligation to return the favor. Thus, a willingness to cooperate and assist others in their experiments is an essential characteristic.

A student's scholastic record may indicate ability to pass individual courses, but even the passing of the state board examinations may not reveal the full scope of his knowledge of pharmacology. Accordingly, many schools demand a comprehensive examination over more advanced course work before admitting him to candidacy for the doctorate and permitting him to select a thesis problem.

Keeping in mind that we are trying to educate the student to get along without us and be a credit to our institution, we must determine as soon and as accurately as possible his probability of success in the difficult task of learning to think in a rational, orderly and objective way, for, after all, education must come from within. Rational thinking demands the ability to distinguish between facts and theories. Easy, one may think for any capable and well qualified student. However, in final examinations of fairly large classes in physiology I have on several occasions asked for the *facts* concerning the coagulation of the blood; as I recall it, not a single student succeeded in presenting the facts without admixing some part or other of a theory or mentioning a theoretical substance.

We also wish to know the student's ability to read and interpret original research articles, rather than the texts and lecture notes that were his mainstay in undergraduate years. Before deciding upon a thesis problem, we should know whether he can present the major features of an article on pharmacology without repeating every word; if he can correlate the material from several such related papers intelligently and present them to a class in a limited time.

Information as to the ability of the student to plan and execute his work also is useful. Procrastination may lead to serious difficulties, as other tasks demanding immediate at-

tention may pile up to upset plans for completing the major objective. Hence, good judgment must be coupled with orderly planning. In this connection one also should watch the student, especially during the early period of his career, to make certain that he learn to complete experiments properly, including the cleaning of apparatus and glassware so that they may be ready for the next day's work.

One aspect demands special consideration in pharmacology,—the attitude of the student towards experimental animals. If the student repeatedly speaks in a derogatory manner of his "dumb animals" or the like, or at any time fails to show kindness towards animals entrusted to him, he does not belong in pharmacology. He must realize that unless a friendly relation exists between the experimenter and his animals, many types of experiments cannot be carried out; the autonomic nervous system particularly is easily upset by fear or disturbances. To leave animals without food and water constitutes a major crime in our field; this must be indelibly impressed upon any prospective student. The proper care of the animals takes precedence over any investigator's convenience!

Specific Course Prerequisites for Entry into Graduate Work in Pharmacology

As to preparation for graduate work in pharmacology, I believe that my own college furnishes a good and well balanced program. In addition to the regular courses in inorganic, organic, quantitative and qualitative chemistry, biology, bacteriology, pharmaceutical and pharmacognosy courses, we now demand one year of college physics. The student is required to complete a full year of physiology with laboratory work, a similar period in pharmacology plus one semester of bioassay and one lecture course in therapeutics. Two years of a foreign language in high school is required also.

Further thoughts on this matter will be found in an article of mine entitled "Preparing the Pharmacy Student for Research in Pharmacology and Bioassay," in the American Journal of Pharmaceutical Education of 1942.

Qualifications of the Professor Giving Graduate Instruction

The choice of the professor who is to give graduate instruction favors a person with the doctorate and, other factors being equal, one with varied research experience. Careful selection is of even greater importance here. It is not difficult to find a socalled "stillborn Ph. D.," a person who after having secured his degree would not accomplish another piece of scholarly work unless driven to do so, or one who transfers his interest and attention from one piece of work to another as new, more promising ideas occur and as a result never gets anything finished. Not only a vivid, but a controlled imagination is really essential.

Pharmacology offers special opportunities for ingenuity in devising suitably controlled experiments for analysing the complex responses of animals to drugs; however, as the apparatus becomes more complicated, one must more thoroughly understand its limitations; also, registration by even the best mechanical means involves pitfalls that must be fully appreciated for correct interpretation of results, and it must always be remembered that not everything is actually being registered during an experiment. One must, according to Claude Bernard, take off the "cloak of imagination" during an experiment. The successful investigator constantly must be on the alert in his observations during his tests, lest important changes escape his vigilance. Many discoveries have come from the ability to take advantage of the unexpected. Like the aviator Corrigan, many an investigator supposedly headed for Hollywood actually lands in Ireland! Striking examples of turning academic research into unexpected fruitful channels were given by Luckhardt in his article "Academic or Unsuccessful Research" in the American Journal of Pharmaceutical Education in 1939.

Imbued with native curiosity, the professor puts his questions as directly as possible to nature and accepts its answers, even though they may not favor some preconceived idea of his. The purpose of a test should be presented to the

graduate student, not the expected result, lest a student be tempted to "stretch" his recording so as to "aid" the professor.

Absolute integrity is essential. A friend of mine visited an investigator in the endocrine field; but when his host admitted that he had touched up some photographs of treated animals "just a little," my friend never went back to that laboratory.

A good memory of past and present work with ability to correlate such work is a splendid qualification. It will help avoid repetition of earlier work; it will prevent the proposal of new theories based on current work, but in conflict with facts established several decades ago. Pharmacological literature abounds in neglected clues. Depressant action by ethylene and inhibition of bacterial growth by molds were noted in the past century and clear-cut directions for obtaining insulin were given by the Russian anatomist Ssobolev 20 years before Banting's independent success! Inasmuch as reviews are not all-inclusive, one may have to delve into past literature to locate such clues. More generally, the professor should be able to express his thoughts clearly and to inspire his students; also essential is patience with the shortcomings of others (as well as his own), realizing that if by good fortune he has succeeded where others have failed, they may not have had his opportunities in life. Modesty is a great asset to any man.

Time will not permit to digress upon the value of the ability to collaborate with members of associated fields, obviously, possession of such an ability should be counted favorably in the choice of a professor.

Let us assume that a college has found a man endowed with the qualifications mentioned above and that his condition of health appears to be adequate to carry out the arduous tasks demanded from him in his dual capacities of teacher and researcher. But let it not be taken for granted that he can or will continue to produce unless he is encouraged to do so. Academic tenure and an ample living wage with prospects for advancement should be given as early as possible to the right man. He may apparently work as hard as ever on a meager

salary, but only apparently so. It is during his leisure hours that his extra-conscious processes should be at work in his field, and his health will ultimately suffer if he must seek additional work. In fact, he should be urged to take vacations of fair duration. That the well remunerated pharmacologist, being free of economic worries, will work more effectively and happily seems self-evident.

Physical Plant and Scientific Equipment Required

But to create a Utopia for the graduate teacher demands much more than tenure, opportunities for advancement and adequate compensation. Modern research demands modern buildings and equipment. Accrediting agencies are constantly on the alert to point out to administrators the need for these; their recommendations should be used freely in the incessant struggle to improve our position by securing the needed funds. Pharmaceutical scientists should not take a backseat and feel content to occupy some old building supposedly remodelled to suit their needs, because it takes the best of planning to secure in a new building the facilities for graduate teaching that we require and, generally speaking, remodelled buildings will not meet this need.

Pharmacology, in addition to ordinary equipment, such as electrically driven kymographs, instruments for operations, and so on, to-day makes special demands. Not only do we need temperature controlled baths, but in view of the extensive reports in the literature showing that even a few degrees difference in temperature may greatly modify fatal dosage in animals, air-conditioned rooms with rigid temperature controls seem essential because temperature varies not only from day to day, but may fluctuate considerably within one day. Also, our animals will fare and reproduce better in air-conditioned quarters. In some cases it is desirable to inject solutions of drugs into a vein over relatively long periods of time; to do this at a uniform rate requires a finely constructed injection machine by means of which one may inject from a fraction of a cubic centimeter per hour up to several hundred: such a piece of apparatus was recently estimated to cost about

500 dollars. In view of the fact that much new light has been thrown upon the mechanism of drug action on individual cells or tissues by studying the influence of drugs upon rates of cell or tissue oxidation, it is now common for a well equipped laboratory to possess a Warburg apparatus with all its appurtenances. One of the most promising methods of following up the distribution and fate of drugs in the body seems to be by injecting drugs synthesized with socalled tagged or labeled elements; not only are such drugs rather costly, but such studies necessitate the use of, for example, a Geiger counter to follow up the distribution of the radioactive substance injected, and training in the use of the apparatus and in interpretation of the results.

As to additional equipment, this depends largely on the research program. Examples would be X-ray equipment, an electrocardiograph, devices for continuous recording of body temperatures, special instruments for operative procedures, and so on.

A Typical Program for Graduate Study in Pharmacology

With a properly prepared student, a good teacher and suitable laboratory facilities, what kind of a graduate program shall we recommend in pharmacology? For candidates for a master's degree we have generally recommended, in addition to the courses in physiology and pharmacology, courses in biochemistry, comparative anatomy of vertebrates and at least one foreign language. When it comes to requirements for the doctorate, knowledge of two foreign languages is a general university requirement; the student should acquire these skills as early as possible—at least a full year before he receives his degree and be made to utilize his knowledge. A course in histology and in pathology would seem necessary also. For a doctorate in pharmacology I would recommend a first minor in physiology and a second in biochemistry or in a field of special interest related to the problem in question, such as physical or organic chemistry, psychology, zoology, pathology, statistics or one of the pharmaceutical subjects. A minor means 10 to 12 credit hours.

How Graduate Instruction in Pharmacology May Be Improved

Certain aspects of creating the best conditions for graduate work have already been touched upon. However, several additional matters need careful consideration in the problem of improving graduate instruction in pharmacology.

Pharmacology departments will lag behind unless technical help is made more readily available. In the first place, regular secretarial help is essential, not only for correspondence, but for preparing manuscripts, lecture notes, outlines, etc. Secondly, a college graduate with inclinations to become a technician may be taught to operate a Warburg apparatus, to carry out chemical tests, to prepare slides, and so on; certainly a professor can spend his time to greater advantage than to wash dishes or carry out routine castrations on rats!

A well-trained and reliable animal caretaker is one of the greatest assets to a pharmacologist. Animals are indispensible to pharmacological research and the validity of our results to a very large extent depends upon their proper care. In many cases we must buy our animals rather than breed them and they must then be housed and kept under observation for a while in our quarters on a uniform diet to make certain they are in good health, are of proper size and age, are not pregnant, and so on; unfortunately, it is still difficult to find animals dealers that can be depended upon to furnish all animals exactly as we specify them, especially for our bioassays.

Finally, as to aid, advances in mathematical treatment of experimental data have worked in two directions. They have helped us plan our experiments so as to get the greatest possible accuracy with a given number of animals, predict exactly what our accuracy will be, determine whether or not our results with an unknown really differ from those with a standard and in various other ways. On the other side of the ledger, our mathematical friends have developed such complicated procedures that many of us have all we can do to understand enough of the principles to conduct our experiments properly, but must depend upon them to carry out the complex

analyses, partly also because they are very time-consuming. Hence, in addition to costly calculating machines to save our time, funds are now needed to engage experts to analyze our data, especially in bioassay problems.

Also, our administrators must realize that a professor cannot keep abreast of developments in his field if he has to teach several subjects; pharmacology, toxicology and bioassay constitute a major field,—a very extensive one at that, because one must also attempt to keep up with important advances in related sciences, as, for example, in physiology. His teaching load in his own field should be kept moderate; one cannot develop numerous courses, do justice to all of them and carry on creditable research; fewer and better courses would also mean that he could and should have several days a week completely free for more protracted experiments, days absolutely undisturbed. An increase in the number of graduate students should be compensated for by a corresponding decrease of his administrative and routine committee duties; time must also be free for extra-curricular obligations, as, for example, scientific and educational societies to which the professor belongs. However, even with ample laboratory assistance, the professor should take some active part in such instruction so as to make and maintain contacts with promising students, to show how such work is done and interpreted and to capture the interest of students by explaining what lies behind the demonstrations. Incidentally, this will aid in training graduate students to become better teachers.

To further improve graduate teaching, encouragement should be given the professor to attend scientific meetings,—preferably with financial aid. This will insure opportunities to meet and exchange ideas with other investigators in his field. Trips to neighboring institutions and the laboratories of pharmaceutical houses also furnish additional ideas and contacts. Similarly, the graduate student should be urged to attend conventions and visit laboratories.

Sabbatical leaves are highly important and beneficial in our program. In different surroundings the professor really

gets acquainted with new techniques and other points of view; valuable friendships are made. It also seems essential that not only technicians should be engaged, but that sufficient funds should be available to pay at least the living expenses of the graduate student, either in the form of assistantships or fellowships. Only when he is freed from the need of seeking part-time outside employment can he really show what he can do, be of value to his professor, participate in experiments which may run into all hours of the day or night and be sufficiently alert to develop new ideas, for real inspirations do not come to a tired professor's or student's mind. Much time is needed to study a problem from all angles and to arrive at its solution, and even then, this is apt to come when one is supposedly at rest.

Opportunities for Graduate Students of Pharmacology

As a final consideration I wish to present a few remarks about the opportunities for men with advanced degrees in pharmacology. As I see it, right now the greatest opportunities should lie within our own colleges of pharmacy, both for teachers and research men; each college should have its own pharmacologist who should be responsible for this field only. Positions for men qualified in doing toxicological work or carrying out bioassays are also available in good numbers in the Food and Drug Administration and in our pharmaceutical houses. Dentistry and veterinary medicine also require expert pharmacological service, and, of course, our medical schools engage a very considerable number of pharmacologists both for teaching and for research. However, the latter schools demand a medical degree for any advanced position; hence any graduate securing a position in a medical school should secure medical credit for any course taken in the medical school, so that it may count towards a medical degree if and when he wishes to take such a degree. Even a student in pharmacy college associated with a medical school should consider this whenever he decides to begin work leading to an advanced degree in pharmacology. In our college, the demand for graduates with a Master's degree in pharmacology has exceeded our ability to supply them for teaching and research

work in pharmacy colleges, pharmaceutical houses, or medical schools.

Summary

In conclusion, a well prepared and qualified student, willing to cooperate and kind to animals, will meet excellent opportunities for doing gradaute work in pharmacology under a professor who can teach him how to plan experiments, to keep careful watch during these, to separate facts from theories and to be absolutely honest in his work. The best progress will be made in modern laboratories with adequate research facilities, as well as proper secretarial, technical, animal-caretaking and mathematical aid, and we should insist upon these. Further benefits accrue from limited teaching fields, reasonable teaching schedules, opportunities to associate with fellow scientists and compensations adequate to free both the teacher and the graduate student from financial worry.

Undergraduate and Graduate Research in Pharmacology in Colleges of Pharmacy*

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During the period of years extending from 1937 to the present an interest in teaching methods and content of pharmacology courses has been increasingly evidenced by faculties of colleges of pharmacy.[1] Dille[1,2] and Hiner[3] have adequately indicated the necessity for and methods of handling this discipline in the pharmacy curriculum. With minor modifications their suggestions are probably acceptable to most individuals concerned with the pharmacologic training

* Read before the Conference of Pharmacognosy and Pharmacology at the 1946 meeting at Pittsburgh.

of pharmacy students. While no one individual has ever doubted the necessity for adequate formalized training in pharmacology for the undergraduate in pharmacy, there has been some question of the place where pharmacologic research both at the undergraduate and the graduate level should take in this curriculum. Dille[4] has outlined the objectives of, and Holck[5] has indicated technics useful in, directing the interest of the student toward pharmacologic research.

At the outset it is recognized that the basic argument against undergraduate research will be found in the pharmacy curriculum itself and that an extra burden would necessarily be imposed on the student if he were required to participate in a research project. Any individual who suggests supplanting portions of the formal curriculum by research courses must answer the criticism that portions of the student's necessary education must be deleted and that he will be placed at a disadvantage when he begins the practice of his profession. It is necessary therefore for some decision to be made as to the importance of research and whether it would be feasible to allow only exceptional undergraduate students to partake of such fruits. At the University of California it has been the policy to select students for undergraduate research from the upper ten percent of the class. It is apparent that such selection usually provides a great saving in time on the part of both faculty and students. The physical facilities and willingness of faculty members to have undergraduates working in their laboratories will largely determine the success of such research programs.

A number of suggestions may be made which can be useful in aiding the student who is interested in research. Holck (5) has admirably outlined methods which can be employed. Further amplifying and building on his suggestions it may be considered that with an agreeable, competent faculty group it is possible to reduce the number of required units of work and replace them by research. The extent of this reduction can only be ascertained by the group of a particular school.

Elective units in research should be built around a functioning research program in progress by members of the faculty. It will be difficult for a student to know exactly in what phase of a particular problem he might become interested. However, instead of stifling his desire to contribute, by burying him in the library, it would be better to introduce him to the research program of the institution by starting him in a small phase of a particular project which does not require great technical skill. If he is an individual who is interested in research, he will not be satisfied by a limited knowledge of this small phase of a research project and will naturally expand his perspective by initiating his own literature surveys. This he should be encouraged to do early in his research career. Since it will in all probability be impossible for a student to complete a single research project which may ramify extensively, it is advantageous for him to work in an area which has been previously explored. It will be gratifying to the student if he can complete a segment of a problem. If the student is not interested in any of the research projects of a particular school, he should be encouraged to develop his own problem, however small it may be.

While it is recognized that the time which is occupied by experimental work will occupy the allotted elective units, further steps to encourage the student should be taken. It can be suggested to those students participating in research that they take an active part in a weekly evening research seminar. During such discussions, a critical attitude toward experimental data can be developed.

With respect to the research fields in which pharmacy students may be interested, it is recognized that many more are attracted to the physical than the biological sciences. Some individuals who are engaged in teaching and research in biologic fields feel that it is unfair to allow pharmacy students to enter into such areas. This is due to the fact that such faculty members are of the opinion that their work may not be of practical value to a student if he should not continue into graduate research. If such justification is required,

pharmacology can be considered to be representative of both physical and biologic sciences. Pharmacology represents a field in which the pharmacy student can participate in research projects which will later be of invaluable aid to him in the practice of his profession.

A system requiring senior theses in which the research student can present his experimental endeavors could be considered of value. Studies could also be conducted during summer and other vacation periods. If honors are to be awarded, such theses could provide the basis for part of the judgment of the faculty committee.

At the University of California some effort has been made to encourage undergraduates in the prosecution of minor research and service projects. While sufficient time does not appear to be available to allow students more than seven units in two semesters during the senior year, it is possible that with revision and intregation of courses more time may be made available for research. Elective work under a preceptor system should be tried. In most pharmacy curricula integration should be instituted in courses of pharmacology, pharmacy, pharmacognosy and biochemistry, since there is a community of interest in these subjects. Studies are needed to determine the degree of integration possible between pharmacy and the physical sciences.

Undergraduate research is highly desirable in that it aids in the selection of graduate students and eventually in potential personnel for colleges of pharmacy.

With respect to graduate research, Daniels and Goyan[6] have discussed the ideals with regard to faculty and physical facilities which they consider necessary in colleges of pharmacy offering graduate degrees in pharmaceutical chemistry. Many of their remarks apply as aptly to pharmacology. However, it should be emphasized that students who have completed the work for the B. S. in pharmacy have not completely satisfied biologic science requirements for pharmacology. Particular attention should be directed toward physiology, mammalian biochemistry, and pathology which are

absolutely necessary to the pharmacologist. Others of the biologic sciences are usually treated adequately.

A curriculum in comparative pharmacology and toxicology has been established at the University of California. This prepares students possessing a pharmacy or chemical background for teaching and research in pharmacology and toxicology. Primary emphasis in this curriculum is not placed on the extensive training in the biologic sciences presented in the first two years of the medical school curriculum. Stress is placed on related fields such as comparative anatomy and pathology, entomology and parasitology. The needs for personnel in the Food and Drug Administration, the Department of Agriculture and in the pharmaceutical industry must be met. Individuals who have been thoroughly trained in comparative pharmacology are adequately prepared for fundamental teaching and research in colleges of pharmacy, agriculture and pharmaceutical industry.

Summary

1. Undergraduate research in pharmacology in colleges of pharmacy can be facilitated by:

(a) allowing more time in the last two years for the selection of elective research units.
(b) directing elective units toward the definite research program of members of the faculty.
(c) emphasizing completion of small segments of an established research project.
(d) establishing seminars constructed around research projects in which students are participating.

2. Graduate research in pharmacology in colleges of pharmacy should be established on the same basis as pharmaceutical chemistry, with emphasis during the graduate years in obtaining further knowledge in mammalian physiology, pathology and biochemistry.

3. The training of personnel in such a biologic science as pharmacology is essential to the future development of col-

leges of pharmacy, federal food and drug laboratories and to the pharmaceutical industry.

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Industry's Requirements of Pharmacology

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At the very start of our discussion I should like to make it clear that the views presented by me are strictly personal. While they reflect experiences gained in 12 years of teaching pharmacology in a medical school and 15 years of directing pharmacological research in industry, I would expect that some statements made on the basis of my experiences might not apply to other industrial laboratories. Requirements which we consider essential, might be less important elsewhere and vice versa. By and large, however, our needs are probably quite similar to those of most research laboratories of the pharmaceutical and fine chemical industry and a description of the varied tasks of our pharmacology division

* Read before the Teachers Conference on Pharmacognosy and Pharmacology at the 1946 meeting at Pittsburgh.

will probably enable you to draw your own conclusions regarding industry's requirements of pharmacology.

The activities of an industrial pharmacology laboratory generally fall in two classes: (a) research and (b) bioassay. Our own laboratory happens to do very little of the latter (approximately only 5 percent of the total man hours are devoted to this task) and we therefore have only a minor need for pharmacologists whose primary interest is in the expert performance of a routine procedure. Conversely, pharmacologists who are excellent in research work might not be satisfactory in a laboratory in which the greater part of the work consists of the repeat performance of standard tests. Work of this type is trying, not only because of its monotony aggravated by need for highest exactness, but also by a constant pressure for speed. It takes a special type of personality to like such work and many capable and well trained scientists are out of place in a laboratory in which the bulk of the activities consists in testing. Yet on this very type of work often depends not only the reputation of a firm but also the successful treatment and sometimes even the life of a patient.

In addition to research pharmacologists and experts in bioassay, an industrial pharmacological laboratory needs large numbers of well-trained, dependable technicians. These people should have a thorough practical training in standard pharmacological technics as well as a sufficient theoretical background to understand the meaning and purpose of the experiments in whose performance they assist. They should possess considerable manual dexterity and should be able to write accurate protocols and reports.

In some laboratories technicians are encouraged to advance their formal education by attending night college classes; occasionally arrangements are made to permit them to enroll in day courses and to make up on evenings for the time lost by going to day-school. I know from personal experience that men who succeed in obtaining a doctorate in this hard and time-consuming way, represent a rare combination

of practical experience and theoretical knowledge, which fits them ideally for leading positions in research laboratories.

The research activities of an industrial pharmacology laboratory may be divided into several groups: (a) collaboration with research chemists in the task of isolating and identifying new therapeutic agents; (b) investigation of the pharmacological and toxicological properties of a new agent after isolation or synthesis, including the development of tests for the maintenance of purity and potency; and (c) research on the potential clinical usefulness of the new drug.

A few samples may illustrate these points. When an extract or concentrate from plants or animal tissues has been found effective against a certain disease, chemical research is directed toward the isolation of the active principle, the identification of its chemical nature and, finally, its synthesis. As long as the chemical nature remains unknown, the only means of following the progress of the isolation consists in the determination of its activity in the various fractions obtained. This task cannot be accomplished without the constant cooperation of pharmacologists, since chemical tests obviously cannot be devised before the chemical nature of the new agent has been elucidated.

It is the pharmacologist who must inform the chemists not only of the approximate quantity of the active principle present in a given fraction, but also of its qualitative identity. After successful isolation, structural identification and synthesis by the chemist, it is again his task to prove that the synthetic material behaves in every respect like the substance isolated from natural sources.

To many chemists, such proof may appear quite unnecessary, since two compounds of equal chemical composition should, *a priori*, have the same biologic effects, regardless of their origin. However, anyone experienced in this field knows that this is not necessarily so, because slight, chemically undetectable differences or unexpected trace impurities might alter the pharmacologic properties. Indeed, some manufac-

turers continue to require biological control even for products that are made synthetically or that are chemically as well defined, *e.g.*, certain alkaloids, amino acids, and vitamins.

Once a new agent has been isolated and becomes available in uniform composition and large quantity, it is the pharmacologist's task to study its pharmacological and toxicological properties, so that the safety for clinical use may be appraised. Such a study not only requires the application of practically every known technic of experimental pharmacology, but also those of allied sciences, such as biochemistry, bacteriology, and pathology. For example, in order to determine whether a new drug may be given by mouth or must be injected parenterally, and in the latter case, whether one daily injection will suffice or repeated injections are needed, a careful study of its absorption and excretion is necessary. This in turn requires a dependable and sensitive method for determination of the drug concentration in blood, urine and feces.

For the proper evaluation of the safety of a new agent knowledge is indispensable not only of its acute toxicity (L.D. 50), but also of the effects of prolonged administration. This may require repeated examination of the functions of various vital organs and organ-systems by X-ray, biochemical or hematological methods, as well as complete macroscopic and histologic post mortem studies. Furthermore, a thorough knowledge of the new agent on circulation, respiration, metabolism, renal and hepatic function, sensory system, *etc.*, will often enable the clinician to guard against undesirable side-effects and hence is part of the information which he should have before starting his first trial.

The list just given is by no means complete, since almost every new drug poses different problems; it will, however, illustrate the point, which I would like to stress, *viz.*, that in an industrial laboratory, research pharmacology may cover as wide a territory as in a university, and necessitating the teamwork of experts in many fields. Obviously, no single individual, regardless of how broad his training and how great

his ability, could be expected to be competent in finding the answers to all the pharmacological questions which accompany the introduction of a new drug, and even if he could solve the complex problem alone, the time required would by far exceed the practical limits.

Ability to work harmoniously in a team is therefore one of the most essential prerequisites for a research worker in an industrial laboratory; he must be willing to coordinate his views and desires with those of his teammates. There are honest differences of opinion as to whether a scientist is better off if he works all by himself or whether he gains even in his own field by close association with experts in related fields. As a general rule, however, a scientist who actually enjoys working in a team will fit particularly well in an industrial research laboratory.

Many of the research problems described above are not strictly pharmacological in nature but belong to the biochemist, bacteriologist or pathologist. Consequently we find, as a rule, in the research laboratories of the drug industry a high degree of specialization. For example, in our own laboratory the following departments are in operation: Experimental pharmacology and toxicology; physiology; neurophysiology; biochemistry; nutrition; medical bacteriology; pathology and, as highly important auxiliaries to all other departments: medical physics (including X-ray and photography) and biometrics. Entirely separate from these departments, which are concerned with research problems only, is a department of biological control.

I am giving you this bird's-eye view of an industrial pharmacological laboratory because it illustrates two points, which in my opinion are industry's chief requirements of pharmacologists: (1) a very thorough-all-round training in pharmacology, with sufficient knowledge of the related sciences to enable a pharmacologist to discuss research problems with associates in other branches of the medical sciences, including clinical medicine; and (2) a personality and willingness to work in a team.

A thorough training in the standard technics of experimental pharmacology, as well as a good knowledge of theory and literature, is an absolute prerequisite. Unfortunately, however, not many schools have the facilities for giving such training and furthermore, there are relatively few students who are willing or able to devote sufficient time to graduate and post-doctorate training in pharmacology. This situation which already existed before the war, has now become quite critical.

There are now probably few good pharmacologists unemployed for any length of time. And I venture to say that the research laboratories of the drug industry and the government (whose requirements are quite similar) could immediately absorb a large number of trained pharmacologists. In addition, there are many vacancies in universities. It is not within the limit of this paper to discuss this very serious problem. But I can assure you that thoughtful men in industry are well aware of the fact that a further depletion of the teaching staffs of universities will further aggravate a condition from which, in the long run, both industry and universities are bound to suffer. There is a general desire to cooperate in any reasonable program that would tend to correct this dangerous trend.

The answer obviously will consist in a very substantial increase in the number of pharmacologists. This requires, in addition to well planned courses, an adequate number of students who are interested in making pharmacology their life career. If they so decide they are certain to find ample opportunities for many years to come, in universities as well as in government and industry and it will primarily depend upon their own personal preferences, which type of employment they choose.

At this point it may be appropriate to comment briefly on the opportunities offered by industry to pharmacologists. In view of the varied research assignments given to an industrial pharmacologist, he will have many chances to advance himself in his chosen profession, provided he is willing to

work in a team and accept certain limitations in the selection of his research problems, which necessarily must fall within the scope of the interests of his employer. He is not burdened by teaching assignments; the technical facilites at his command usually are excellent; he is given an ample number of assistants and technicians whenever such help is available. There are, within reason, no limitations placed on the purchase of the various supplies needed by him for experiments and new or special equipment may readily be obtained.

There is a widespread feeling that a scientist in an industrial research laboratory is controlled by hard-boiled business executives, who prescribe the selection and execution of his research; that he is frequently ordered to shift from one problem to another whenever business interests so dictate; and that he has to give up scientifically promising work, if it may not seem to be financially profitable. From my own experience I can state that this is a misconception. Rather, the opposite is the fact and it would indeed be bad business if industrial research would be run otherwise. Enlightened executives fully realize that a research organization is no better than the men working in it. No real scientist would be willing to associate himself with an organization that deprives him of the opportunity to advance in his own field. A laboratory run along such principles would soon be ostracized and find itself unable to attract research workers of high standing, the only ones who offer a reasonable degree of probability that the large sums spent on research ultimately will bring returns. It is well known, that the cost of maintaining a research organization is rather high and is justified only if it accomplishes its objectives. These are, above all, the discovery of new products and the creation of good will through the advancement of knowledge. This cannot be done without good men; and to obtain and hold such men it is necessary to offer them an atmosphere and working conditions essentially not different from those in a university.

Contrary to opinions occasionally found in insufficiently informed circles, industrial research laboratories generally

encourage publication of scientific results. Again citing from personal experience, the scientific publications from our laboratory during a 5-year stretch numbered 114 for a research staff of 10 professional scientists; this about equals the number usually emanating from an academic laboratory of comparable size.

A pharmacologist's decision to remain in a university or to join an industrial research laboratory will depend upon whether he will be happier in teaching and in academic surroundings, or whether he prefers the tempo of an industrial laboratory with its usually more ample facilities and greater remuneration. Whichever choice he makes, however, one thing he must never forget: Industrial laboratories are positively not a place for second-raters; here, as everywhere else, the advancement of an individual is in direct proportion to his ability and accomplishments.

What Are Industry Requirements of Pharmacognosy Research and Teaching?*

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In discussing the subject assigned to me, an effort will be made to explore the field from several points of view, principally those of Production, Control, and Research—the three divisions of the pharmaceutical industry in which science plays a large part. The writer will dwell largely in this paper on what he believes are the material requirements for a successful day-to-day pursuit of the profession of Industrial Pharmacognosist. It appears that little attention relatively is given in academic discussions to this phase of pharmacognosy.

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* Read before the Conference of Teachers of Pharmacognosy and Pharmacology at the 1946 meeting at Pittsburgh.

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The identification and validation of crude vegetable and animal drugs by external macroscopic appearance and organoleptic tests are not difficult tasks for one who has had practice under proper instruction or direction in the handling of such materials. To illustrate, the mill hands in a drug warehouse lacking any formal education in pharmacognosy can often accurately identify hundreds of the items they are called upon to receive or deliver from stock.

The routine passing on identity of many batches of crude drugs (an important duty of the industrial pharmacognosist) is on the whole then something which an individual of average intelligence can learn to do properly from experience. The "rule of thumb" method of identification in the gross state is not to be treated with contempt for actually it is just this which the college course itself provides as a chief means. The inspection and evaluation of crude drugs are duties carried on in the laboratory of the crude drug houses by men who have often been trained in the elements of pharmacognosy altogether by practical working contact with drugs in the industrial plant and not primarily by academic courses in materia medica. Thus, while these workers are not perhaps pharmacognosists in the sense that they have completed extensive collegiate work in this subject, they can assuredly be said that to perform their work satisfactorily they must be and are competent to recognize the regular true and spurious crude drugs and otherwise evaluate quality by the various simple means which are useful and available. The more detailed microscopic, chemical, and biological tests and assays are competently applied by individuals with training in these particular fields.

Likewise, domestic field operations are carried on by people who have had apprenticeship in the art rather than formal education in the science of drug plant collection and preparation. These people have mainly grown up in the traditions and lore of their trade. They are the descendants of generations of herb collectors. It is really remarkable how few are the errors they make in their garnering and prepara-

tion of many different plant species and how essentially honest they are in the proper dispatch of their activities. Intentional adulteration of our American drugs is almost nil.

Granted then that a considerable proportion of the routine handling, collection, preparation, and examination of crude drugs is effectively conducted along traditional lines, we must understand that the proper and unique value of the specialist in pharmacognosy comes from his application of a technical knowledge of plant relationships, morphology, histology, chemistry, uses, etc., to the particular question involved. Only relatively difficult problems such as those arising from matters of adulteration, novel or unusual drug materials, powdered drugs, mixtures of materials, establishment of new sources of supply etc., represent worthy subjects for the application of his special skills.

It is agreed that there is today a need for pharmacognosists, but this need is by no means restricted to the commercial field. Actually, there is a very definite lack of pharmacognosists in many other departments of human endeavor —such as in various scientific institutions and in governmental agencies which deal with economic plants.

The writer is in complete accord with Wirth's views as expressed in 1943[1] stressing the need for pharmacognosists in government work. A want of balance and effectiveness in the activities and decisions of governmental agencies is frequently apparent. Even the rules and standards set for botanical materials are sometimes impractical and putting it bluntly, actually unscientific. The following example may be cited:

In the purchase of spices by the Federal government, the vendor is compelled to provide an article meeting all specifications. The specifications for spices given here is typical:

> "All deliveries shall conform to . . . the following. Shall be prepared in accordance with the best commercial practice, under strictly sanitary conditions, from clean, sound, pure products. Spices shall be made from the true aromatic vegetable substances from which no portion of any volatile or other flavoring principle has been removed, and *shall be free from* artificial coloring matter, adulterants and *impurities*. . . . (italics are the writer's)."

A spice must then by this ruling be absolutely free from impurities, the least trace if discoverable constituting a violation of the purchase agreement and of Federal requirements. This manifestly is absurd. Unfortunately this instance as quoted is only too typical of the difficulties encountered by commericial firms.

In the case of drug materials, it should be quite obvious that the greater the amount of and care in garbling, the higher the cost to the pharmaceutical manufacturer and eventually to the ultimate consumer. Why should an unwarrantedly high standard of purity be set on materials which only incidentally enter into medicinals? In actuality, most drugs are extracted by percolation or some related process in which the the menstruum has often definitely germicidal properties. In such instances, should the presence of a very small percentage of foreign matter constitute a major disqualification? Is it economically feasible for instance to remove by hand garbling (often an expensive operation) the remains of those foreign plants, insects, and other organisms which normally are found growing within and on plant materials? Obviously there are practical limits, but the ruling cited and others like it make no such provision.

There is no quarrel with any effort to improve the quality of drug and food materials. There should certainly be strict laws governing the output of materials for human consumption. When however, for legal purposes presumably, the regulations prescribe a quality which is manifestly unattainable and impracticable, it tends to encourage a feeling of ridicule and disrespect in the minds of the many concerned.

Generally speaking, standards for crude drugs are now and rightly so the highest they have ever been in this or in any other country. The quality of drugs on the market shows a great improvement over those days seventy years ago when an outstanding pharmaceutical manufacturer in the middle West refused to purchase powdered drugs as they were then offered on the open market, declaring them to be universally

adulterated. Nowadays, powdered drugs that are adulterated or sophisticated are comparatively rare.

There is a common point where relative purity and economy meet, a balance which works for the maximum betterment of the consuming public, and it is unwise to alter this equilibrium too much either way. It should be the special task of practical pharmacognosists to properly compile, regulate, and interpret the many standards applying to plant materials having medicinal or related usage. Let us therefore hope the day soon will come when there will be universal acceptance of the necessary place to be occupied by the pharmacognosist not only in the college, in industry, and in commerce, but also in the research institute, in the governmental bureau, in the botanical garden, in the experiment station, in the museum, and in the technical library. Let us also hope that wherever he is the pharmacognosist will help to inculcate more reasonable and pragmatic attitudes.

Now to discuss the special requirements of the pharmacognosy practitioner in industry, requirements I conceive to be of the utmost importance.

First in rank is the need for type collections of authenticated crude drug and other plant materials. The necessity for having such specimen archives, together with an herbarium of pressed plants, is manifest. The botanical herbarium as ordinarily known preserves in systematic arrangement representative specimens of the leaf, stem, flower, fruit, etc., of plants of small to average size. Where the plant is large and any of these structures bulky, only fragments may be available for study. Fruit and seed collections sometimes serve as adjuncts to an herbarium of pressed plants, and are of particular interest to pharmacognosists. Fruits if woody are generally kept dry in boxes, while fleshy fruits are usually preserved in bottles in liquid.* It is however unusual to find adequate specimens of the bark and wood at various ages, or of the underground organs.

* A unique feature of the N.Y.B.G. collection is the preservation in liquid of entire plants or plant parts of many medicinal plants, employing for this the largest size of museum jar. Complete and intact specimens were used after careful identification.

A collection of crude drug materials is useful not only because it gives access to otherwise unavailable plant materials, but also because it permits a study of the material *en masse*. The worker may handle the product in exploratory fashion by crushing and smelling, tasting, removing portions for microscopic study, etc. It is generally undesirable to remove parts of an herbarium specimen for detailed examination, unless special provision has been made for same by means of an envelope attached to the sheet. The ideal arrangement which should certainly be followed wherever possible is to coordinate herbarium and drug museum specimens. Thus when roots are gathered, the collector should also press and mount specimens of the above-ground parts and key these accurately. Such procedure would forestall possible error in identification, and would be of real and permanent value to both herbarium and drug collection.

The leading collections of crude drugs on public display in this country are (as far as the writer is aware) those of the United States National Museum at Washington, D. C., and the New York Botanical Garden (Economic Museum) in the Bronx, New York.

The New York Botanical Garden collection is of particular interest because it was built up almost entirely through the efforts of the late Henry Hurd Rusby, while Honorary Curator of the Economic Collection (1898-1940). He is said to have done this work almost entirely in his spare time and with no further monetary recompense than honoraria totalling a few hundred dollars. Rusby also did the major share of development of the Herbarium and Plant and Drug Museum at the Columbia University College of Pharmacy. This accumulation of materials has greater diversity and value for study than the Botanical Garden Collection, which latter, however, serving as it does for public display, contains generally larger quantities and finer specimens of the exhibited item. The New York Economic Museum displays are now gradually being dismantled with the eventual purpose of setting them up for reference study.

There are several other museums of materia medica available however for serious students to make use of.* Thus, the economic plant collections of the Chicago Natural History Museum (formerly the Field Museum of Natural History) which under the custodianship of the late Charles F. Millspaugh appears to have developed into quite an important resource, is now (at least temporarily) not on exhibit and is presumably not handy for reference use on account of a lack of trained personnel[3]. At one time it is said that this collection was of special value in exhibiting various grades and types of the individual item[4].

There are also of course many scattered collections of drugs such as those of various bureaus of the U. S. Department of Agriculture (like that of the Bureau of Entomology and Plant Quarantine, New York City).

The various university and college collections (such as the Harvard University Botanical Museum, and the museums at the University of Wisconsin*, Columbia University College of Pharmacy, and other educational institutions) are generally unsatisfactory for use by outsiders, because of the restrictions imposed by distant location, lack of personnel, inadequate cataloging, complex or confused arrangement, etc., etc.

In the older nations of the world, collections of materia medica are (or were) apparently more numerous and more complete than in the New World. This comes about perhaps because these have been established over a longer period, even for centuries and during times when interest in crude drugs was generally more intense than at present. Various botanical gardens (such as the Royal Botanic Gardens at Kew, with its "Museums of Economic Botany"; the Museum of the Botanical Garden of the Academy of Sciences at Leningrad; etc.) possessed valuable collectanea acquired over a period of many, many years. The various colonial museums (for instances the Handels-museum of the Kolonial Instituut at Amsterdam, the Japanese Colonial Museum, etc.) had rich collections of overseas plant materials.

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*Also compare the Philadelphia Commercial Museum.
*Claimed sometimes as the most complete in the United States. (5)

It would seem that in the United States the example of the Pharmaceutical Society of Great Britain might well be considered. This oganization has for a period of over a hundred years (1842 to date) built up a superb collection of both domestic and foreign drug materials, a collection available in ordinary times for research and laboratory control purposes[6]. This aggregation of items of the materia medica is said to be pre-eminent in its field in England[7].

Quite obvious are the advantages to pharmacy of a reference or research collection of type specimens of crude drugs if it is supported and administered in a comprehensive and sufficiently elaborate manner. Such a study collection is not suited to display before the general public, who mostly visit museums for pleasure more than profit.

A central storehouse of Materia Medica like this could be serviced in such a way as to furnish materials on a loan or exchange basis. A staff of one or two full-time curators with assistants should be adequate to administer such a repository.

It would seem appropriate that such an institution as this should have the support of the important organizations concerned, as the American Pharmaceutical Association, the National Association of Wholesale Druggists, the American Association of Colleges of Pharmacy, the National Foundation for Pharmaceutical Education, the American Pharmaceutical Manufacturers' Association, the American Drug Manufacturers' Association, the Proprietary Association of America, the Canadian Pharmaceutical Association, the Canadian Pharmaceutical Manufacturers Association, and other similar groups.* Members of these organizations (including as they do the importing, exporting, and manufacturing pharmaceutical and chemical houses) would benefit from such a depository, and the cause of scientific progress would be served.

Originally, it was planned that the Pharmacy Headquarters Building should have a pharmaceutical collection, with

* There are no trade associations of crude drug suppliers as such.

"exhibits of the natural drug resources of the nation as well as those of foreign countries."[8]

If this general suggestion would not prove practicable, there is a possible alternative solution to the problem of finding adequate reference samples when desired of any one of the thousands of kinds of plant and animal medicinal materials described in pharmacopoeias, dispensatories, and other reference books, besides the many which are known but not yet described in the literature. That could be accomplished by the compilation of a master list of unusual crude drug specimens preserved at the various institutions here and abroad. There are only a few American plant museum collections with printed inventories (Chicago N. H. Museum; N. Y. Botanical Garden; U. S. National Museum (lists of the latter very old)). Various institutions, such as pharmacy colleges and university departments of economic botany, having unusual or specialized collections (such as many types of a single product or items of historical interest) could well furnish itemized lists of their specially interesting specimens. The benefit to the cooperating institution would be access through loan or permanent exchange to specimens otherwise practically unobtainable.*

The chief benefit to research would come from the opportunity a specialist would enjoy of examining as large a collection as possible of the particular product under study, thereby encompassing a series of more adequately representative materials than otherwise would be possible, and in consequence doing a more complete job of research. For the published record, the researcher would quote institution name and item inventory number, in the same way as taxonomists now permanently fix the identity of their herbarium source materials.

The benefits of permanent drug collections are fairly obvious:

(a) Ensuring proper identity and quality of an article.
(b) Determining the characters of a particular item formerly known but now never seen.

* The Museum of the Pharmaceutical Society of Great Britain appears to have been active in effecting exchanges of this sort.

(c) Providing materials urgently needed for preliminary chemical or physiological study; thus sometimes avoiding months of delay.

Collections of phytochemicals and their derivatives are naturally of great interest to pharmacognosists. Such collections are found in the New York Botanical Garden's Economic Museum; in the Chandler Memorial Chemical Museum (at the Columbia University Department of Chemistry); and elsewhere.

A second important resource of the pharmacognosist, and one which is every bit as important as the drug collection, is the herbarium. Herbaria or collections of pressed dried plants are most essential to an adequate study of plant materials. Fortunately, there has been much well deserved interest in the development and maintenance of these collections and in most cases the curators have a generous and efficiently organized loan system. Nevertheless, there are great gaps in the geographic coverage of American herbaria—such for example as the total inadequacy of African materials.

It is highly desirable that every college of pharmacy and similar institution have its own herbarium for preservation of all common medicinal plants growing in its general vicinity. It should be considered an important requirement in all research work in phytochemistry, pharmacology, etc. that adequate specimens be preserved of the plants with which the work was concerned. Without such a permanent and concrete record, the value of the chemical or pharmacological or other work may prove eventually worthless, since errors in identification of plant materials are only too frequent*. There are other excellent reasons for preparing reference herbarium sheets:

—for some plant entities, there is lacking uniform agreement as to identification, even among professional taxonomists;

—new species or subspecific entities are constantly being segregated from older specific groups;

* Cf. case of **Mentha arvensis** complex species misidentified as **M. piperita.** The oil was studied by several people and the data incorporated in such compilations as that of Wehmer's **Pflanzenstoffe.** Had not herbarium specimens and photographs been kept, the basis of these data would have been passed into the literature unchallenged (J. A Ph. A. 33: 333. 1945).

—there is much difference of opinion over varieties, etc., botanical subdivisions which are especially important to the phytochemist, (volatile oils, etc.)

Plainly, the simple introductory statement that such and such a plant species was used in a particular research study is not adequate evidence at all of the particular plant entity concerned.

A third important source of reference material is the Drug Garden. In recent times, several well known Medicinal Plant Gardens have unhappily been discontinued. The value of living plants in research and in teaching programs is apparent on reflection:

—to provide materials for phytochemical study—thus, for the preparation of certain enzymes, volatile oils, etc.
—for physiological studies, e.g., in determining the effect of certain elements on production of active principles.
—for cytological preparations.
—for facilitating preparation of histological mounts.
—to provide materials for class-room study: it is of course easier to study botanical characters in the living plant than in the dried specimen. The habit of the plant is largely lost when the plant is mounted, and since field identification depends to a great extent on plant habit, use of the fresh plant is a considerable help in this branch of study.
—for genetic research.
—for conducting experimental drug cultivation and preparation.

A welcome development of recent years has been the renascence of interest in herb gardens. Typical examples are the herb plots at the Brooklyn Botanical Garden, New York; at the Cloisters Museum, New York; at the Cathedral Gardens in Washington, D. C., etc.

An inventory of medicinal plant specimens being cultivated in outstanding gardens of the United States was prepared by the U. S. Department of Agriculture[9] several years ago. It would be useful if this listing could be revised occasionally.

Libraries are another desideratum for practicing advanced pharmacognosy. Pharmacognosy libraries which approximate self-sufficiency or essential adequacy are few in number, probably because pharmacognosy covers such a wide

variety of subject-matters. In the writer's experience, the Library of the U. S. Department of Agriculture provides the most complete available collection in the subject, while there are excellent resources at the University of Wisconsin and several other pharmacy schools, the Army Medical Library, the N. Y. Botanical Garden Library, the N. Y. Academy of Medicine Library, the Lloyd Library, and elsewhere.

The chief problem is of course the searching of periodical articles, which contain so much of the valuable detailed information required, much of which is never recorded in books. The writer has previously compiled the chief serials having pharmacognostic content[10]. To determine the specific location of a desired journal, reference is best made to the Union List of Serials (2nd ed. together with Supplement). Other locating aids of less value are: "List of Periodicals Abstracted by Chemical Abstracts"; "The Catalog-Index to the Surgeon General's Library" (Army Medical Library); U. S. Dept. of Agriculture Library periodical listings; etc. What are not available in these various sources may generally be found in the exhaustive card index accumulations of the Union Catalog, at the Library of Congress, Washington, D. C.

Unfortunately it happens quite often that scientific periodicals or parts of same cannot be located in this country as far as determinable. A recent typical example of many in the writer's experience was the serial *Trabajos del Museo de Farmacologia* of Buenos Aires. The Union List has no awareness of anything published beyond No. 3 . . (the need was for No. 6); apparently only two American libraries have any issues at all, and these only of the earlier numbers. This example can be multiplied. A need for even greater interest in the foreign literature would seem to be indicated.

By means of library loans, microfilms, and photostats, the resources of nearly all UL cooperating libraries are available at moderate cost and trouble to an interested person. It is unfortunate that more pharmaceutical libraries do not cooperate with the Union Catalog and furnish an inventory of their serial accessions. Pharmacy libraries which have taken part in the UL listing include: the colleges or schools of

pharmacy at the Universities of Illinois, Maryland, Washington, Florida, Minnesota, California, Southern California, Iowa, Ohio, North Carolina, Michigan, Oklahoma, Kansas, Nebraska, Georgia, Mississippi, Purdue University, and the Philadelphia College of Pharmacy.

Summary

Essential requirements both for academic work in pharmacognosy and for the utilization of pharmacognosy in the practice of professional, industrial and commercial pharmacy include the following physical assets:

(A) Comprehensive, available, well-ordered, carefully labelled and annotated, and thoroughly catalogued collections of crude drugs and pressed herbarium specimens.

(B) Medicinal plant gardens.

(C) Specialized libraries of books, serials, and pamphlets, with provisions for borrowing literature from other libraries and for reading microfilm.

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Chemurgic Research with Drug Plants*

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In the agricultural civilization that has developed, man has learned to grow crops to satisfy his wants. The knowledge which has been acquired and utilized has led to a healthier and happier people, but continued and further progress is only possible with further scientific knowledge. As a unit of our agricultural system, chemurgy is not a new force. Its concept which drives in the direction of abundance in its province, which is the plant world, point to continued progress in man's struggle for a higher plane of living.

Plants as organisms, are far more plastic in their hereditary basis than has been believed. The many examples of how wild species of plants and cultivated varieties, possessing varied potentialities, have been combined and recombined to produce specialized hybrid forms, each having characteristics especially suited to a peculiar condition, illustrate the paths of adaptation which are almost limitless.

The plant breeder has had as his main concern those plants as crops which produce nutritional principles — starches, sugars, proteins, and fats. The minor crops, those which produce basic chemicals, drugs and vitamins, have been somewhat overlooked. It is in this latter category that the chemurgist is directing his efforts and it is in the field of drugs in which the pharmacognosist is particularly interested. With the beginning that has been made, this field should be productive of gratifying results.

The prodigious effort that has gone into developing the acceptable drug plants we possess today must not stop on the basis of selection, as it has with so many of these plants, but must progress through experimentation with inheritance. We know enough about plants to assert with confidence that

* Presented before the Conference of Teachers of Pharmacognosy and Pharmacology at the 1946 meeting in Pittsburgh.

the physiological character is conditioned in its expression by two sets of forces, environmental and heredity. Effective progress will depend upon the range of hereditary variation in the plant and this can be determined only through thorough investigation.

A chemurgic program, cooperative between many of the colleges and departments of our university, has been established. The College of Pharmacy as a participant is cooperating with all problems involving studies of plants which produce medicinal principles, and a separate division of drugs and related crops is now a part of the program. The objectives of the studies which have been initiated have been to improve the value of the plant. As we learn more and more about plant substances and plant processes our focus will be directed to alter the process to produce more of the substance. This field of endeavor has barely been opened, but the future appears bright. Of the several studies that have been completed, or are nearing completion, the experiments have been carried on to scales which might be considered semi-commercial, and this is to determine exactly the possibilities which the plant might have in the market of today.

The distinct advantage of a program such as ours is in that it has the cooperative assistance of individuals who are experts in all fields of study. It is my opinion that this type of research activity will go far to establish a better understanding of plant processes and towards productive research. All problems or studies of this nature are necessarily long term programs. The laborious crossing methods coupled with the polyploidy technique are time consuming and many generations of plants are necessary to acquire a certain knowledge. It is not anticipated that all of our studies will meet with success, nor will the results be miraculous. The plants under current investigation include coriander, the mints, sesame and alfalfa.

The value of such a program to research problems in a graduate program in the field of pharmacognosy and plant

chemistry is inestimable, and it is our ambition to utilize the opportunities which we have. As the program progresses, graduate assistance and fellowship grants are anticipated to allow expansion and greater effort.

Biochemistry in the Pharmacy Curriculum– Optional or Required Subject*

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In 1939, Chairman Burlage of the Syllabus Committee appointed a subcommittee on Biochemistry. This committee consisted of Dr. C. J. Klemme, of Purdue, the late Dean C. L. A. Schmidt, of the University of California College of Pharmacy, Dr. J. C. Forbes, of the Medical College of Virginia, and the writer. To the Committee was assigned the tasks of surveying the teaching of biochemistry in colleges of pharmacy, of appraising the various courses available to students of pharmacy and of recommending whether biochemistry should be made a *required* subject for students in colleges of pharmacy in the revision of the Syllabus, or whether the subject should continue to be an *optional* one.

As a part of the study by the Committee, a questionnaire was submitted to all the colleges of pharmacy of the Association. Replies, in some cases incomplete, were received from 51 schools, The present discussion is based, in part, on the replies received. Although no more recent survey of biochemistry in our colleges of pharmacy has been attempted, it is believed that the data secured in 1939 reflect rather acturately the teaching of biochemistry in our schools today. A

*Read before the Conference of Teachers of Chemistry at the 1946 meeting at Pittsburgh.

study of current catalogs of the various schools has indicated that there have been few changes during the period of the war so far as biochemistry is concerned.

The questions submitted in the questionnaire will be presented and the answers obtained will be briefly summarized.

1. Is a formal course in biochemistry available for students of pharmacy in your institution?

Forty-one schools answered this in the affirmative; nine had no provision for instruction in this subject; in one, instruction in biochemistry had been temporarily discontinued.

2. Is this course in biochemistry elective, required of all students, or required in certain curricula?

In the twenty-two of the schools in which biochemistry was available, the course was elective; in eighteen, required (in one case, this question was not answered clearly). In several schools, it was not required in all curricula, but was required of students in the curriculum of clinical technology. In a number of schools, some biochemistry was included in a short course of urine or clinical analysis.

3. How many hours of credit are given for biochemistry? Is laboratory work included?

In nineteen schools, three to four hours of credit were given; in one school, less than three hours of credit; in eight, five to six hours and in ten, seven or more hours. It was difficult to estimate hours in some cases from the information given. Laboratory work was included, almost without exception.

4. Is biochemistry taught in the college of pharmacy by a member of your own immediate staff or in some other related department or division (e.g., chemistry, medical school, etc.).

The close relationships between colleges of pharmacy and university departments of chemistry in those schools in which the college is a part of a university is shown by the fact that in eighteen schools, biochemistry was taught in the depart-

ment of chemistry; in eight schools, the work was given in the medical school; in one case, in a college of agriculture; and in sixteen schools, by the staff of the college of pharmacy. (There is some duplication here, as in some schools, more than one course in biochemistry was open to students in pharmacy.

Those schools which were units of university groups in which strong divisions of biochemistry existed, either as a part of the department of chemistry or of the medical school, and in which geographic relationships (*i.e.*, on the same campus) permitted, have usually made use of the facilities of these groups and have made available to students of pharmacy extensive courses which are comparable to (in many cases identical with) those offered to professional students in medicine, dentistry, or chemistry. One dean in answering this query commented thus: "Our students are taking their work with young medical students and make friendships which carry over into their professional lives." The advantages of such contacts with students of the other health sciences have been emphasized by other administrators in personal conversations.

In other schools, in which such facilities were not available, or which for various reasons did not wish to utilize such facilities, biochemistry was taught in the college of pharmacy by a member of the immediate staff of the college. As far as could be judged by a study of college catalogs, courses taught in other divisions than the college of pharmacy were usually more extensive, broader in content, and appeared to conform fairly closely to the outlines of the Syllabus. Courses taught in the colleges of pharmacy appeared to be more variable in content than the courses taught in chemistry or medicine. In a few instances, in this group, the work was taught by a man trained as a professional biochemist; this appeared to be the exception rather than the rule in this group. As a whole, the courses given by members of the pharmacy staff were less extensive, more utilitarian and in many cases, included only simpler chemical pathological methods in which urine analysis was emphasized. These courses frequently presented also

various phases of clinical microscopy including blood counting. The broader aspects of biochemistry were frequently neglected.

Many of those who stated their belief that biochemistry should be a required subject were undoubtedly thinking in terms of these briefer more "practical" courses. In may instances, facilities (staff or laboratory) are not available for the organization of a broader course given by a trained biochemist. A practical course in urine analysis (frequently wrongly classified as biochemistry) has been considered a "bread and butter" course by those who have emphasized the opportunity for pharmacists to offer to physicians the services of a clinical laboratory. This may have been the fact some fifteen years ago. It is the opinion of the writer that the opportunity for pharmacists to conduct clinical analyses (outside of hospital pharmacies or laboratories) has been greatly restricted in recent years and that this limitation will be extended even more in the next few years. Registration of laboratory technicians is strongly urged at present and will undoubtedly be required in the near future. Training for medical laboratory technology will be highly specialized and the pharmacist without more training than is afforded by some of the "bread and butter" courses available can hardly qualify.

The most common objection to the inclusion of biochemistry as a required subject was "curriculum too full". Other comments of those opposed included "cannot introduce more allied sciences without subjecting pharmacy to a secondary level", "too many basic or tool subjects now", "perhaps required if a prepharmacy course becomes necessary", and "would make elimination of essential courses in pharmaceutical chemistry necessary".

Those who advocated biochemistry as a required subject were as a rule definite in their conviction of its value. A few typical comments are cited: "Strongly recommended if not actually required, condense much of the older work to give place for chemistry in pharmacology," "should be closely co-

ordinated with pharmacology", "fundamental as well as broadening", "one of the most valuable courses in chemistry", "biochemistry would be a far more fruitful field than much of the hodge-podge now received" and "senior students regard the course as one of the best courses given in the four years".

As a result of these studies and of considerable correspondence, the Subcommittee voted, but not unanimously, to recommend to the Syllabus Committee (a) that biochemistry be continued as an optional subject, (b) that the minimal number of didactic hours should remain at forty-eight and that if possible, the number of laboratory hours should be increased to ninety-six or a total of one hundred and forty-four hours and (c) that biochemistry could best be studied by the pharmacy student after completion of the work in organic and preferably quantitative analysis and that when possible, biochemistry should precede or accompany the courses in physiology and precede pharmacology. Certain changes in the descriptions of the content of the course as given in the Syllabus were recommended.

The Subcommittee also expressed its opinion that *whenever possible*, biochemistry should be taught by one who has had adequate professional training in biochemistry, as evidenced by at least a year of graduate work in the subject. It was realized that this would be difficult to achieve in some cases and if required, might cause some hardship. However, as an ideal, there was, in the opinion of the group, no question of its desirability.

At the time of the final report of the Subcommittee (1939), it was my feeling that the inclusion of biochemistry as a required subject would be necessary within ten years unless the trends in professional pharmacy and in medicine changed materially. This conviction has not been altered. The increasing emphasis on chemical approaches to medical treatment, the newer concepts of antibiotics, of vitamins and hormones, the advent of the sulfa drugs, the problems of antagonistic action between drugs, all require the chemical approach obtainable through biochemistry, the study of the

living organism. If the practioner of pharmacy is to cooperate intelligently with the physician of tomorrow, he must possess an adequate knowledge of the normal chemistry and functions of the human body, a knowledge which is best obtained from a combination of physiology and chemistry.

One other aspect of the problem deserves some consideration. At the same time that our Subcommittee on biochemistry was considering the problems already outlined in this discussion, the Syllabus Committee was seeking a revised definition of physiology. The definition which was finally accepted was "That science which deals with the physical and chemical regulation of the processes of life". There has been some tendency to emphasize the physical and anatomical aspects of physiology. The definition adopted by the Syllabus Committee makes it clear that in the opinion of this group, physiology is not to be considered primarily from the anatomical or physical point of view and that the chemical regulation of life is of equal importance with the physical to students of pharmacy.

It will be seen that this definition in one sense includes biochemistry. It will be remembered that biochemistry originated in our medical schools as a branch of physiology and that, in many English groups, it is still taught as chemical physiology. Chemical physiology, physiological chemistry, biological chemistry or biochemistry! It matters little under what heading the subject is taught. The basic knowledge should be imparted to every student of pharmacy. It is the task of our facilities to determine how the problem can best be solved by our individual groups. Conditions in each school vary. It is our duty to see that our graduates are properly equipped to meet the challenge of a medicine that is becoming increasingly more biochemical and perhaps less anatomical.

The symposium arranged by our chairman today seems to me particularly significant. Biochemistry is at the cross roads as far as pharmaceutical education is concerned. Shall we make available the best instruction on a broad basis or shall we continue the utilitarian courses in urine or clinical

analysis which have been too frequent in the past? Shall these courses be required of all students? How can room be made in an already overcrowded curriculum for a new required subject? How many hours should be available? What division of time between lectures and laboratory is desirable? What should be the content of the courses? What type of texts best fits the needs of the pharmacy students?

It is hoped that these and other related subjects may be freely discussed today. From this symposium, it is to be hoped that this Conference of Teachers of Chemistry may be able to make some recommendation to the Syllabus Committee. Required or elective, the courses in biochemistry for students of pharmacy must be strenghtened according to the facilities available in each of our schools.

Biochemistry in the Pharmacy Curriculum*

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My assignment in this symposium is to point out "the importance of biochemistry to the present-day pharmacist and student of pharmacy."

It is doubtful if any pharmacist who has had a course in biochemistry needs any enlightenment along these lines. It is true, however, that pharmacy has developed so rapidly in the past twenty-five years that it has been difficult for any teacher to keep in touch with the progress of all subjects outside his own specialty. There may be an excuse, then, for those in the teaching field who have never had a course in biochemistry, if they fail to understand how it applies to pharmacy.

One of the strongest points in favor of biochemistry in the pharmaceutical curriculum comes from the practicing

*Read before the Conference of Teachers of Chemistry at the 1946 meeting at Pittsburgh.

pharmacist. I have yet to find a pharmacist who has had a course in biochemistry who feels that this course should be deleted from the pharmaceutical curriculum. Incidentally, I have heard a surprising number of complaints about some of the better established courses, but never a word against biochemistry.

We must keep in mind that we are not teaching subjects but are teaching students. Biochemistry is merely a convenient term for subject material that is closely associated with all the other science courses in Pharmacy. True, biochemistry may be looked upon as a course in chemistry dealing with inorganic, qualitative, quantitative, physical, and organic chemistry; but it is not presented as such; it is given to the student as the chemistry of the living organism, and mostly as the chemistry of the animal body, particularly the human body. If only more time could be given to this course, the chemistry of plant life also would have much to offer the pharmacist.

There are certain fundamental principles that are peculiar to biochemistry, and it is self-evident that the pharmacist cannot think clearly and logically about these principles unless he knows them. However, we cannot limit the teaching of biochemistry to the fundamental facts only. In order for the student to understand them and make proper use of them he must be helped with example and practice.

We may illustrate this point by choosing a well-known fact in inorganic chemistry. We teach that the acid salts of the alkali metals are readily decomposed by heat to give the normal salts. This is particularly true of the acid salts of the more volatile acids. This basic fact takes on added significance when we point out that a solution of sodium bicarbonate should not be sterilized by heat. The pH of the solution changes materially as the sodium carbonate is formed. We point out what the consequences might be if this principle is ignored. Factual information supported by example and practice gives the student the kind of wisdom that is essential in the art of compounding. The same procedure can be used

very successfully in the teaching of biochemistry to the student of pharmacy.

One way to understand the importance of biochemistry to the present day pharmacist is to examine certain work in which biochemical knowledge is involved, and to see how ready he is to perform it.

One example that came to my attention involved the physician, the pharmacist, and the patient. The patient in this case was a diabetic who had been hospitalized and whose diet had been carefully worked out. The day before the patient was to be discharged from the hospital he was given a Solution of Magnesium Citrate. Neither the physician nor the pharmacist knew why this patient suddenly developed hyperglycemia and glycosuria. The patient received a caustic over-hauling by the physician for cheating on his diet, and what was even worse, he was told that he was lying about it. Without going into further details about this case, we may infer that the physician thought of Solution of Magnesium Citrate in terms of its title; and while I am not excusing the physician, I do believe that the pharmacist should have called the physician's attention to the 60 cc. of syrup in this prescription, just as he would call a physician's attention to an overdose of atropine. The sins of omission are just as real as those of commission in pharmacy, as in any other walk of life. The importance of biochemistry to the present day pharmacist is certainly shown in such a case. The upsets that have been caused by penicillin lozenges because of the sucrose, the gelatin, or other glycogenetic materials in these preparations come under this same category.

A second example deals likewise with a series of preparations used by diabetics, but here the offending ingredients are not so well known. In this case the pharmacist has to have a little better background in biochemistry that was indicated in the first example.

The preparations selected for this example are taken from The Pharmaceutical Recipe Book (1). A book which

"represents the outcome of an effort of the American Pharmaceutical Association to place in the hands of the practicing pharmacist a reliable and comprehensive book of recipes."

Part I-B—page 294 is devoted to "Preparations for Use by Diabetic Persons." Three different preparations selected from this list will give us ample data for the discussion of our second example.

(a) Sugar-Free Aromatic Elixir;
(b) Sugar-Free Iso-Alcoholic Elixir, High; and
(c) Sugar-Free Elixir of Terpin Hydrate.

Either saccharin or soluble saccharin is used as the sweetening agent. They are all sugar-free. But, all three contain alcohol and glycerin. The quantity of alcohol and glycerin amounts to about 50 per cent of the total in (a), over 99 per cent in (b) and about 83 per cent for (c).

The facts that these preparations come under the heading "Preparations for Use by Diabetic Persons" and are further camoflaged with the phrase "Sugar-Free," imply that the pharmacist knows the biochemical significance of the ingredients in these preparations and, as the preface of the Recipe Book indicates, that they are reliable recipes. However, those implications do not seem to be true—if the things we teach in biochemistry are true.

We teach that "conditions that alter carbohydrate oxidation have a parallel effect on the oxidation of alcohol" (2). We point out that "the livers of depancreatized, diabetic cats have lost the power of oxidizing alcohol almost completely, whereas, the livers of depancreatized insulin treated cats, have the normal oxidizing power" (3).

We teach that glycerin like glucose gives rise to glycogen in the liver. In diabetes produced by means of phlorhidzin, glycerol is practically quantitatively converted into glucose (4).

Is it not clear that these sugar-free preparations for use by diabetic persons need revision? And, would it not be wise

to make use of a pharmacist who has had a course in biochemistry when they are revised? Many of us try to excuse our guilt in errors of this kind by saying that these preparations are based upon physicians' prescriptions. But we know that we have no valid excuse. If the physician knew everything and was always right the pharmacist would need little education. The physician turns to the pharmacist in those matters which the pharmacist professes to know. Why should the physician question the pharmacist if the pharmacists implies that his preparation is based upon sound physiological principles? Since many of our preparations contain ingredients other than those implied in the name, it is about time for us to understand our obligations in this matter.

For our third example I have chosen a problem that may seem to be wholly unrelated to pharmacy; but as we study it more carefully it stands out as the kind of material that belongs to no one as much as it does the pharmacist, and it does point out how biochemistry helps the pharmacist to solve problems of this character.

This case deals with the findings of the pathologist. He has found that many children died of starvation because they had pancreatic fibrosis. He has found that similar cases could be diagnosed correctly while the patients were still alive. Hence, he knows what is wrong with such patients and what they require in order to live. He knows these patients are unable to secrete pancreatic enzymes, and unless these enzymes are made available to them, at the right place and at the right time, or unless the food is predigested for them, that these patients will shortly die. At this point we encounter a strictly pharmaceutical problem. The part that biochemistry has played along with pharmacy in this work is now history. Predigested food in the form of protein hydrolysates are among our newest therapeutic agents. The use of these drugs has been extended materially, and the present-day pharmacist is in need of biochemical knowledge in order for him to take his part intelligently in the preparation and compounding of these new medicinals.

There is still a great deal of work required of the pharmacist in this field. A keener knowledge about the biological significance of the amino acids is needed. What effect do various reagents and drugs have upon the therapeutic value of these substances? How can these substances be made more palatable without rendering them therapeutically ineffective? The importance of biochemistry in the basic education of the present-day pharmacist should need no further amplification.

However, many more examples could be given if necessary, to point out the importance of biochemistry to the present-day pharmacist and student of pharmacy. Some are as simple as those already given; others are a little more complicated. A simple preparation like an effervescent salt suddenly takes on added significance and calls for a drastic change in its ingredients. The mineral-salt vitamin preparations on the market do not look right to me, and other biochemists agree with me that considerable modification will have to be made if the things we teach in biochemistry are true.

Biochemistry has truly made remarkable progress in the past decade. A sizeable portion of Chemical Abstracts devoted to biochemical articles attests to this fact. We believe that pharmacy should keep pace with this progress. There is no point in developing miracle drugs and specifics if these drugs are not going to be compounded properly. What the pharmacist doesn't know about biochemistry can hurt him and it can hurt the trusting public.

In conclusion may I make this suggestion. The man who takes over the teaching of biochemistry should be first of all a biochemist. He should not be chosen merely because he happens to be a successful teacher in one or more other fields and happens to be available when the vacancy must be filled. He must also have the interests of pharmacy at heart. When this is done we shall be satisfying those practising pharmacists who agree about the importance of biochemistry, and no longer be forced to waste time in debating the obvious.

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A Discussion on the Subject Matter for Biochemistry*

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Teachers of biochemistry are concerned with the chemical processes which go on in living matter. Many of these process are touched upon in several of the other courses which a pharmacy student takes during his college career. By discussing the subject matter desirable in such a course, it is apparent that one agrees with Dr. Lewis that biochemistry is worthy of attention, and with Dr. Bauer that biochemistry is important to present-day students of pharmacy.

Whenever a faculty decides that biochemistry is to be presented, two immediate problems must be solved: first, where the biochemistry should be placed in the curriculum, and secondly, how much time should be devoted to its teaching. Regarding the former of these, it seems logical to place biochemistry in the junior or senior year, after the completion of inorganic and organic chemistry, quantitative and qualitative chemistry, physiology, and bacteriology. Pharmacology would not necessarily be a prerequisite.

*Read before the Conference of Teachers of Chemistry at the 1946 meeting at Pittsburgh.

At the present time, 19 colleges offer courses in biochemistry, ranging from 32 didactic hours and no laboratory to 112 didactic hours and 192 laboratory hours. A few colleges offer such related courses as Blood and Urine Analysis (3 schools); Preparation and Application of Physiological and Pathological Reagents (1 school); Glandular Products (2 schools); and Biological Products (8 schools). It seems possible that an adequate course could be taught in one quarter or one semester of 32 to 40 didactic hours and 65 to 130 laboratory hours. An attempt has been made to base the following discussion upon this minimum.

Due to the nature of the education of a pharmacist, the true subject matter of biochemistry is encroached upon in a number of courses in colleges of pharmacy. The physical aspects, such as hydrogen ion concentration, buffers, surface tension, colloids, emulsions, and osmotic pressure are all developed in other subjects. Certain courses in pharmacy and in organic pharmaceutical chemistry deal in some degree with much in biochemistry. A close coordination of subject matter is, therefore, necessary between biochemistry and other pharmacy courses. There is sufficient worthwhile biochemical knowledge so that it would seem that none of the courses should be lacking material.

Carbohydrates, lipids, and proteins are, logically, the first groups to be studied. Although these three have been covered in organic chemistry and mentioned in physiology, there are certain aspects which must be particularly pointed out in a biochemical discussion. The classification of each group, with its degradation products and qualitative tests, and in some instances, quantitative methods, should be well covered.

In carbohydrates, the hydrolytic products of disaccharides and polysaccharides should be discussed, along with fermentation and the parts played by enzymes and coenzymes. The carbohydrates particularly important to pharmacy should be stressed.

Under fats one may include waxes, phospholipids, and sterols.

Proteins deserve as much attention as can be allotted to them. Amino acids must be well considered, with the essential ones emphasized and mention made of those that have been recently synthesized. Nucleoproteins offer an opportunity to bring in purines and pyrimidine compounds and to point out the value of phosphorous as phosphoric acid.

The chemistry of the tissues calls for information on bones, teeth, and muscle, nerve, epithelial, and connective tissue. Each of these offers possibilities of including material closely associated with pharmaceutical products.

Digestion and Absorption lectures will, necessarily, be influenced by the course in physiology, but much can be said about composition of enzymes, hydolytic products, source of hydrochloric acid, function of bile and bile pigments, putrefaction, detoxication, and absorption. Recent findings on the absorption of drugs could well be incorporated here.

Metabolism studies should make mention of carbohydrates, proteins, fats, minerals, water, and energy. Glycogen formation and insulin function are important, as are fat storage and oxidation, formation of tissue protein, and conversion of protein into carbohydrates and fat. Mineral metabolism must include the essential elements, making necessary a discussion of thyroid, dental caries, anemias, and bones. Energy metabolism offers the opportunity to explain basal metabolism, calorimentry, and the adequate diet.

A knowledge of body fluids and excrements is of direct value to a pharmacist and the study should, therefore, include blood, bile, urine, lymph, perspiration, and feces. A discussion of bile leads to remarks about cholagogues and the pharmaceutical products derived from bile. Blood is important enough to allow inclusion of such topics as new medicinal products derived from blood, anemias, folic acid, dicoumarian, heparin, and liver preparations.

Since urine analysis may well be carried on in a pharmacy, this subject deserves thorough treatment. The pathological constituents of urine offer the opportunity to bring

in information about diabetes, acidosis, gout, and nephritis.

Hormone lectures should be centered on those hormones which are the source of pharmaceutical products. Insulin forms and uses should be explained. Synthetic compounds such as B-phenyl ethylamine derivatives and stilbestrol, having hormone activity, are suitably included. The use of thiouracil may be incorporated in the study of the thyroid.

The field of vitamins is so large that one must carefully choose that biochemical information most useful to a pharmacist. In any discussion, after the well-established ones have been covered, recent findings on such materials as folic acid, biotin, vitamin p and nutrient x, may be pointed out.

As you can understand, the assignment to discuss the subject matter which should be included in a biochemical course is somewhat difficult. Biochemistry is a standard subject and has a large number of textbooks devoted to it. If biochemistry is to be taught to pharmacists, a strictly biochemical course of study should be followed. The formulation of a biochemistry course just for pharmacy students does not place the pharmacists on the same plane with other scientifically educated groups and does not provide them with an equal opportunity when competitive examinations are required for employment.

Dispensing Pharmacy as the Culmination of the Pharmaceutical Curriculum*

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Early in the development of the pharmaceutical curriculum, it was realized that the college must supply the professional experience which was becoming increasingly difficult to obtain in the retail pharmacy. A course, which would be

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devoted chiefly to the compounding of physicians' prescriptions, to be given as the terminal course in the Department of Pharmacy, seemed to offer the best means of bridging the gap between the academic world and that of the practice of the profession. Thus, the course in Dispensing Pharmacy was added to the curriculum and eventually became a required subject in the Pharmaceutical Syllabus.

Unfortunately, the full possibilities of the course in Dispensing Pharmacy have not been realized in many colleges. In some cases, where the college of pharmacy is associated with a medical school, the dispensing laboratory hours are devoted almost entirely to serving a hospital or a clinic. While this may be expedient, both in obtaining laboratory material and in the matter of income, it is not adequate for the purposes of the course. Hospital and clinic staffs are composed of relatively small numbers of physicians. When the laboratory work consists of compounding the prescriptions of such small groups, it tends to become stereotyped and repetitious. If a hospital or clinic formulary is in use, the variety of the work is further circumscribed.

In other cases, the laboratory work consists of a small number of prescriptions, perhaps not more than one hundred, these prescriptions being compounded by each member of the class. Such a small number of prescriptions, no matter how carefully chosen, could not possibly constitute satisfactory prescription experience. Furthermore, it is likely that the prescriptions chosen would be chiefly of the problem variety, thus giving the student a false idea of the nature of prescription practice and robbing him of the confidence and facility essential to a good pharmacist.

In still other cases, adherence to the outline of Dispensing Pharmacy in the Pharmaceutical Syllabus has resulted in the presentation of a course which is, in part, a dreary and monotonous repetition of elementary material which had been presented during the first two or three years of the curriculum. The outline has thirty major divisions; sixteen of these

are devoted to elementary study of classes of preparations which presumably, were adequately treated in the course entitled Pharmaceutical Preparations. The study of pharmaceutical preparations, as distinguished from prescriptions, does not belong in a course in dispensing; rather, it is a fundamental study which is prerequisite to dispensing. That the present outline of Dispensing Pharmacy in the Syllabus misses this point entirely, is shown by one of the two stated objectives, which reads as follows:

> "To present to the student the fundamental principles of prescription compounding by means of a detailed study of each class of magistral preparations both in the classroom and in the laboratory."

Dispensing Pharmacy can and should be more than just the terminal course in the department of pharmacy; it should be the culmination of the pharmaceutical curriculum, the course toward which all of the other courses of the curriculum are oriented, since it is here and only here that the student has the opportunity to apply the knowledge and skill gained in these courses to the professional activities for which he is preparing. It can be such a course if it is broadly conceived, properly organized, presented in well-equipped laboratories, and administered by teachers of vision who see in the course in Dispensing an unparalleled opportunity for effective teaching.

That the course has failed to reach its full possibilities may be due, in some instances, to the outline in the Syllabus. This outline is narrowly conceived and, if followed, could only result in a poorly organized course. Repeated protests by the author and his associates to the Syllabus Committee have failed to secure revision of the outline. Where a few have failed, many may succeed and it is hoped, therefore, that this Conference will see fit to recommend to the Syllabus Committee that the outline of Dispensing Pharmacy be revised. In order to stimulate discussion of the matter, a tentative proposed outline forms a part of this paper.

DISPENSING PHARMACY

Recommended: *Third and Fourth Years — or Fourth Year*
Didactic Hours — Minimum, 64; *Laboratory Hours* — Minimum, 128; *Total Hours* — Minimum, 192.

Dispensing is the culmination of the pharmaceutical curriculum. It is in this division of the curriculum that the wide range of knowledge gained from other courses is applied. It requires an accurate familiarity with many specific operations and facts connected with receiving, compounding, dispensing and delivering a prescription as well as a very high degree of skill in the techniques involved. Its objectives are (1) to facilitate the application of the knowledge gained in other courses, (2) to bring about the required familiarity with the many specific operations and facts connected with this phase of pharmaceutical practice and (3) to develop the technical skill which is so essential for success in it.

The course includes both didactic and laboratory instruction. For best results, it is recommended that the laboratory work be conducted with small groups of students in a well equipped prescription laboratory, under close supervision of the instructors. Such a laboratory has a stock of the specialties of the pharmaceutical manufacturers as well as the usual stock of drugs, chemicals and official preparations. It is equipped, also, with telephones for the receipt of prescriptions and all other facilities which are typical of the equipment of a professional pharmacy.

The objectives of this course may best be realized by devoting the greater part of both the didactic and laboratory hours to an intensive study of many prescriptions from current files. The number of prescriptions available for assignment in the laboratory should be sufficiently great to insure that each student will have the opportunity of dispensing all of the recognized types and yet that there will be little repetition. This will necessitate that there be available not less than 100 prescriptions per student, or about 3,000 for the average class of 30 students. An opportunity should be pro-

vided for each student to study the prescriptions filled by all of the other students of the class. Probably the best way to accomplish this is to post the prescriptions daily on a bulletin board after they have been dispensed. It cannot be too strongly emphasized that the prescriptions used should be selected from files which vary widely in nature and in geographic location, and that new prescriptions must constantly be added and old ones discarded if the laboratory work is to meet the demands of current practice.

The subject matter is organized in six divisions, all of which may be given during the two semesters of the senior year or they may well be spread over the second semester of the junior year and the two semesters of the senior year. The divisions are as follows:

1. General Principles and Regular Procedures.
2. Proprietary Preparations.
3. Incompatibilities.
4. Biologicals, Reagents, Bacteriological Stains.
5. Medical Appliances, Sick Room Supplies, etc.
6. Advanced Practice and Special Problems.

I. GENERAL PRINCIPLES AND PROCEDURES.

Classroom

The prescription.
- Ethical and legal considerations.
  - Copies and "refills."
  - Narcotic, cannabis, liquor.
- The responsibility of the pharmacist.

Receiving the prescription.
- By messenger (patient or other person).
- By telephone.

Routine procedure.
- Identification of prescription.
  - Call check.
  - Name and address of patient.
  - Serial number (refill or new).

Judging the prescription.
- Reading the prescription carefully.
- Recognition of ingredients.
- Dosage.
- Use.
- Method of administration.

Compounding the medicine.
- Use of proper method for each type of preparation.
- Indication on the prescription of any information needed for refilling.
- Knowledge of probable appearance of finished product.

Finishing the prescription.
- Container and closure.
- Labels, regular and auxiliary.
- Special wrappers.

Pricing.
- Use of manufacturers' price lists.
- Use of pricing schedules.
- Codes.

Checking to avoid errors.

Filing the prescription.

Delivery of the medicine.
- Advice on administration and storage.

Replenishing stock.
- Use of "want book."

Laboratory

The work in the laboratory in this division of the course is devoted to the filling of relatively simple non-proprietary prescriptions for each class of preparations. The emphasis is chiefly on the development of a good routine procedure. The prescription filling is supplemented with extemporaneous manufacturing of the more complex preparations described.

II. PROPRIETARY PREPARATIONS.

Classroom

The lectures and recitations are on the specialties of the leading manufacturers. The manufacturers' representatives should be enlisted in the instruction whenever possible. The specialties of each of the leading manufacturers are studied as a group. The student is expected to become familiar with the name of the specialty, the package units in which it is supplied, its general nature, its therapeutic indications, dosage and all the common incompatibilities.

Laboratory

The laboratory work consists of simple prescriptions for proprietary products closely co-ordinated with the didactic work. The laboratory instruction includes the use of the manufacturer's catalogues and price lists.

III. INCOMPATIBILITIES.

Classroom

The lectures and recitations deal with the several types of incompatibilities and the methods of overcoming them when it is advisable. The subject of making changes in prescriptions with and without consultation with the physician is included, always endeavoring to concur with the intention of the prescriber.

Laboratory

The work in the laboratory is coordinated with the didactic work and includes the filling of incompatible prescriptions of the several types. The work is arranged in the order of increasing difficulty and includes official, non-official and proprietary drugs and preparations.

IV. BIOLOGICALS, REAGENTS AND BACTERIOLOGICAL STAINS.

Classroom

The lectures and recitations include a consideration of the official ampuls, proprietary ampuls, diagnostic reagents

and bacteriological stains. The student is expected to become familiar with the appearance of each product, its use and the storing of it. Particularly should he be able to recognize a deteriorated product.

Laboratory

Types of ampuls, reagents and stains are manufactured in the laboratory. Standard methods for checking the quality of these are employed.

V. MEDICAL APPLIANCES, SICK ROOM SUPPLIES, ETC.

Classroom

The lectures and recitations deal with the classification, the sources of supply, the standards for judging the quality, the uses, the methods or technique of use and the prices of these products which are frequently ordered to accompany medicine or are supplied to the patient on verbal order. Atomizers, thermometers, catheters, syringes and hypodermic needles, drinking tubes, crutches, hot water bottles, and ice bags are among the products of this division.

Laboratory

Filling prescriptions and other orders for the materials discussed in the lectures and recitations comprises the work in the laboratory of this division. It involves the selection of the proper article for the particular purpose in each case.

VI. ADVANCED PRACTICE AND SPECIAL PROBLEMS.

Classroom

The classroom work consists of conferences on the dispensing of the more complex prescriptions which are filled in this division. Problems brought in from outside prescription counters are discussed and solutions proposed.

Laboratory

The more complex prescriptions and other orders are filled. The work is arranged to be typical of that found in an active professional pharmacy and includes homeopathic and

veterinary prescriptions. The use of mechanical aids, such as capsule machines, suppository compressors, and ointment tube fillers is developed in this division of the laboratory work.

Experimental work is carried out in striving to solve the problems in prescription compounding and formula improvement that are submitted for study.

The "Prescription Forum" as a Method of Teaching Incompatibilities*

JOSEPH B. SPROWLS

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One of the most difficult problems which confronts the teacher of Dispensing Pharmacy is the task of presenting the subject of incompatibilities. The list of drugs with which a practicing pharmacist must deal has become so tremendous that the number of individual problems which might be presented is almost infinite. But the teaching schedule does not allow the use of a great many hours in attacking the subject. It is true that the incompatibilities may be classified and dealt with for the most part by groups or types, and a previous paper[1] has dealt with one method which may be used to encompass in one study a large number of the incompatibilities which result from the use of modern synthetic drugs. But the task of condensing the material which must be covered is still a most difficult one.

In planning his laboratory teaching, the instructor seems to have two possible avenues of approach:

1. To require each student to compound a relatively large number of prescriptions with rather specific directions being supplied by

*Read before the Conference of Teachers of Pharmacy at the 1916 meeting at Pittsburgh.

the instructor as to the proper method of compounding in order to avoid incompatibility under consideration.

2. To require each student to compound a selected group of prescriptions which demonstrate the classical types of incompatibilities, with a more thorough study being made of each incompatibility and of methods for its correction.

The latter method would seem to have the greater permanent value to the student, but it is more difficult to cover a wide variety of examples when this procedure is used. The former method allows the student little opportunity to develop his own initiative in the solution of compounding problems which he must sooner or later learn to solve by his own initiative.

The method which is to be discussed is one which has been used by the author for the laboratory study of incompatibilities. It seems to have operated satisfactorily and is believed to have helped both in increasing the number of prescription examples which can be studied and in increasing the students individual experience with the solution of incompatibility problems.

At regular intervals during the dispensing course each student is assigned for compounding a prescription which involves an incompatibility problem. Each student receives a different prescription than the others in the class though all of the prescriptions given at one time may represent the same incompatibility type. The examples are selected from textbooks of dispensing pharmacy, from periodicals, and from other sources. The assignments are selected in such a way that they follow an outline of incompatibility types and are illustrative of that outline.

The student compounds each prescription at least two times—once as written and once as it should be corrected. If he wishes to investigate more than one method of correcting the incompatibility, he is allowed to do so. At a general meeting of the class, each student presents his prescription to the class and discusses with them the incompatibility problem involved, explaining the cause of the incompatibility and the

method or methods by which it may be avoided or corrected. All members of the class are thereby given the opportunity of seeing the actual change which takes place when each prescription is compounded as written as well as the result which is obtained when a suggested method is used for avoiding the incompatibility. Since each student has prepared a different example, the number of problems presented to the class is multiplied many times. A number of good examples can be presented and discussed in a half-hour of class time. If an incompatibility type seems sufficiently important that all students should actually experience it, the assignment can be given to all and the instructor can present the discussion.

This plan of study lends itself to many variations. For example, in the study of dry powders which tend to liquefy when mixed, each student may be given a different combination of ingredients—or of the same ingredients in different proportions — and a comparison made of the results. By this method students learn that some incompatibilities are dependent upon the relative proportions of ingredients present in a prescription and offer no difficulty when the amount of ingredients present is ideal. By seeing the results of different methods of correction, they are better able to decide the best method of avoiding or correcting an individual problem.

The plan may seem too cumbersome for use with large classes, but two possibilities are evident: (1) to assign the same problem to groups of students and choose one to present his discussion to the class, or (2) make the special assignments as special problems to a few students at each time and to move progressively through the class. Students may be supplied with loose-leaf sheets bearing in mimeographed form the prescriptions to be discussed in each "forum" with ample space provided for the writing of notes or comments about each. This greatly facilitates the presentation of larger numbers of examples, and is almost an essential if the method is to be utilized with larger classes.

The method as presented seems to have the following virtues:

1. **A large number of prescription examples can be demonstrated and actually examined by the members of the class in a given interval of time.**
2. **The students see the uncorrected prescription as well as the correctly compounded prescription and are able to observe the urgency for correction as well as the actual result achieved.**
3. **The student's interest is somewhat enhanced by the knowledge that he must discuss his own problems before the other members of the class. This encourages investigation of the literature so that he may be well-informed concerning the particular problem concerned.**
4. **Students seem to develop an investigative attitude toward incompatibilities and seem to regard their correction as one of the intriguing research tasks of the practicing pharmacist.**
5. **The study of incompatibilities is distributed through the dispensing course so that the student is not faced with the necessity of learning a great deal of factual material in a brief interval of time, but can assimilate it rather gradually.**

It is not suggested that this method of teaching is original with the author, since others may use a similar or identical method of teaching. Neither is it advocated that others should use this method, since individual instructors must have their own methods of presentation. It is presented merely as a suggestion of a method which can be used for increasing the coverage in this complex field of instruction. The author is thoroughly convinced, however, that an investigative attitude toward incompatibilities should be developed in the mind of the pharmacy student so that he will take pride in his ability to find methods of the avoidance of or the correction of incompatibilities as they occur. In order to do this he must have a real understanding of the problems involved and cannot merely learn by rote a series of incompatiblities and of methods for their correction. Incompatibility problems constitute a class of problems whose solution is distinctly the duty of the dispensing pharmacist. He should be trained in such a way that he is capable of intelligently analyzing these problems

and of carrying through to a satisfactory conclusion an investigation of methods for their correction.

Reference

1. SPROWLS, JOSEPH B., "Functional Groups in the Teaching of Incompatibilities."

Pharmaceutical Economics in the Postwar Curriculum*

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Thoughout the war years when faculties of pharmacy schools were laboring under difficulties of accelerated courses, no vacations, shortages of manpower, shortages of students, and a host of other problems, their hopes were focused on a bright postwar period. Today, that postwar period has not yet arrived. Legally the war has not yet ended; so, technically, the bright "postwar" period is still ahead. This is not said with disillusionment, for already there are many signs that pharmaceutical economics courses in pharmacy schools are moving in the right direction.

The goal for pharmaceutical economics courses is still courses of a highly practical nature, of college grade, taught by specialists. The demand for each of these points has long existed and continues to exist. In fact, so urgent is this demand, and some schools so slow in making recognition of it, that business is taking the lead in many places and fields in providing to our graduates information and services that should come from the schools.

There is little need to recount the many examples of such activities in business, for they are known to the educator, but a few are mentioned nevertheless. A leading pharmaceutical manufacturer has for years offered the service of analyzing the financial status of druggists submitting their accounting

* Read before the Conference of Teachers of Pharmaceutical Economics at the 1946 Pittsburgh meeting.

figures. He has also spent much effort in the field of sound buying principles. Another pharmaceutical manufacturer is now offering to its agency drugstores a complete business service including assistance in locating a new drugstore, store layout, stock control, buying plans, and similar services. Progressive pharmaceutical publishers are conducting various question-and-answer columns and printing series of articles on basic principles of management.

All these services are commendable, but because they cannot be complete nor always or generally available, they merely emphasize the present failure of some pharmacy schools adequately to prepare about 75 per cent of their graduates for their life's work—retail drug store operation.

The continuing need and interest in business subjects after graduation is seen in the overwhelming demand for such topics in refresher courses. Almost without exception, open requests for suggestions for refresher course topics reveal this demand.

The present profitable condition of retail pharmacy should not be an argument against needed improvement in pharmaceutical economics courses. It is true that retail pharmacy has seldom seen a more profitable period, but this was and still is due to conditions that cannot long continue. During the war years profits were forced upon retail druggists by decrease in the number of retail outlets, a plentiful supply of most drug store merchandise, practically no price control on prescriptions, increased earnings of customers, a shortage of help which increased the working hours of proprietors, a decrease of costly services such as delivery and fancy wrapping, an inability to spend for new fixtures and remodeling, a decrease in new products which resulted in acceptance of previously slow-moving stock with an improvement in inventory position, no price cutting, frozen costs of rent, insurance and utilities, the general absence of overtime pay, an acceptance of inconveniences by customers, a decrease in debt with resulting interest savings, and an increase in the number and average price of prescriptions.

Under such conditions, practically no management or business skill was required for success, but skill is necessary under the returning normal competition and a buyers' market.

Once again this fall, pharmacy schools will have the duty and the opportunity to remedy this basic shortcoming in their pharmaceutical economics departments.

During the next two years no school should have to complain about a shortage of entering students. If estimates are correct, every school will have more applicants than it can accept, and many more than half and as high as 80 per cent of the entering students will be veterans. It is because most students will be veterans that pharmaceutical economics courses should be made more practical and complete, immediately.

Studies have indicated that the veteran is "older" than his years. His intelligence and scholastic attainments range over the same scale as former non-veteran students, but his seriousness and appreciation of reality and practicality is a new challenge to teachers. He possesses none of the bravado of veterans of the first World War, for the veterans' education laws have largely curbed such tendencies. He studies not only for passing grades, but also for the continuation of his educational funds, and frequently in preparation for the utilization of veterans' loans. His goal is more frequently proprietorship than employment. Further, he has chosen pharmacy as a career in the advanced years of a normal educational age, and in some cases war injuries, marriage, or the crystallization of a personal philosophy have had their stabilizing influence.

Instructors will discover that this seriousness expresses itself in many ways, one of which is the veteran's questions. Generally presented after class, these questions will be specific, practical and timely, and very frequently in anticipation of material yet to be covered. For example, instead of asking how many people will support a drug store, he may wish to know if the Forest Hills section could provide a druggist with a living income; instead of how much money is required to

open a drug store, he may wish to know if his insurance has a loan or surrender value or what the current rate of interest is; instead of a per cent of sales figures for drug store help, he may ask if it is possible to hire a fountain man for $30 a week and how many sales will be required to keep such a man employed.

The veteran's observations of the profession of pharmacy are usually as pointed as are his questions. His emphasis not infrequently tends toward the practical rather than the theoretical.

In this single observation of seriousness and realism, there is found both the demand for more practical pharmaceutical economics courses and the need for specialists as teachers. It is true that an instructor can, if he is so inclined, dismiss the question with a promise that the matter will be considered later and in due course, but the immediate damage and inefficiency is apparent in such action.

To any realist, it is evident that the veteran's nature emphasizes anew and in very sharp focus the long existing, though generally more distant, demand for practical, college grade pharmaceutical economics courses in our schools of pharmacy.

What is to be our answer?

The American Institute of the History of Pharmacy and the A.Ph.A. Section on Historical Pharmacy.*

ARTHUR H. UHL

University of Wisconsin

When, at its 1904 Kansas City (Mo.) meeting, the American Pharmaceutical Association added a Section on Historical Pharmacy to the other four American Pharmaceutical Associ-

* Presented before the joint meeting of the Section on Historical Pharmacy of the American Pharmaceutical Association and the American Institute of the History of Pharmacy at Pittsburgh, Pa., on August 28, 1946.

ation Sections then in existence, to those on Scientific Papers, Commercial Interest, Pharmaceutical Education and Legislation and Practical Pharmacy and Dispensing, it did something entirely and fundamentally new. The men who decided upon the creation of the new Section not only recognized the intrinsic value of the history and the traditions of the profession, but they assumed the responsibility of the representative national American Pharmaceutical Association for the preservation, cultivation and utilization of the non-technical aspects of pharmacy.

Being the first representative of nationally organized pharmacy of the entire world to make "Historical Pharmacy" one of the officially pronounced parts of its responsibility, the American Pharmaceutical Association had no proved pattern to be followed. Furthermore, all that was done had to fit into the general structure of the association. With the authority of the national organization the Section has offered a program each year on the occasion of the annual meetings of the association. From the beginning the Section has done an excellent job throughout the more than forty years of its existence in awakening and maintaining historical interest within the profession.

The answer to the question why it could not do more than it has is closely connected with the historical development of the other four Sections, the scope of their activities and responsibilities. It is understood that this development will be presented when the history of the American Pharmaceutical Association is written. At this time a few statements concerning the part played by the Section on Historical Pharmacy may be in order.

The formation of the "Sections" of the American Pharmaceutical Association for special groups of interests in 1887 remained strictly within the old frame of the association with its then very limited financial and administrative means. It did not, and perhaps could not, add anything new to its aims and functions. It was an excellent organizational, but not a creative act. As such it made the problems in question more

obvious rather than offering the means of solving them. By doing so, the Sections of the Association, in direct contrast to the hopes of their organization, served as an incentive to the establishment of supplementary institutions.

But the time that the Section on Historical Pharmacy was established, the sections devoted to debating their specific problems found themselves in the company of associations devoted to permanent activity in the respective fields. As to "Scientific Papers," "Pharmaceutical Education" and "Practical Pharmacy and Dispensing," it was the Conference of Pharmaceutical Faculties, founded in 1900 and called the American Association of Colleges of Pharmacy since 1925, which furnished continuity and the necessary concentration on the respective problems. The National Association of Retail Druggists, in existence since 1898, provided a kind of permanent economic laboratory and observation post as well as special means of fight concerning "Commercial Interests" and the "Legislation" touching these interests. As to the enforcement of pharmaceutical legislation the National Association of Boards of Pharmacy, founded in 1904, supplemented the picture.

These separate organizations, to which were added the College of Apothecaries in 1940, and the American Society of Hospital Pharmacists in 1942, have, by no means, diminished the value of the parent association or of the "Sections." On the contrary, they have proved the need of an all comprehensive organization representing pharmacy on the whole, blending all the various interests and aims into one harmonious unit, and offering each of the separate groups an opportunity of presenting itself to the entire profession. It is significant that in the course of time the administration of the American Pharmaceutical Association has, itself, shown a tendency to departmentalize, creating laboratories of its own and to give consideration to the establishment of special bureaus in which consistent work may be devoted to special tasks.

Thus, experience has proven the necessity of permanent institutions for *consistent* work in the special fields of phar-

maceutical interest on the one hand, and of opportunities as represented by the Sections of the American Pharmaceutical Association for the presenting, blending and checking of this work on the other hand. It is understood that this statement, proved in all other fields of pharmaceutical activity holds true for the historical field likewise.

It is significant that almost at the hour of birth of the Section on Historical Pharmacy the need for some kind of a permanent center was recognized. The father of the pharmaceutico-historical movement in the United States in general, and of the American Pharmaceutical Association Section on Historical Pharmacy in particular, the late Edward Kremers recommended, in the discussion preceding the creation of the Section, the establishment of "The Office of Historian—, such an office to be permanent as associate to the succeeding chairman of the Section."[1] The recommendation was approved with one characteristic limitation, namely that the incumbent be elected annually.

For nine years the continuity of planning and reporting which Dr. Kremers tried to achieve, was to some extent accomplished by his being elected historian again and again until, in 1913, he refused re-election. In 1915 E. G. Eberle, the newly elected Editor of the *Journal of the American Pharmaceutical Association* which was established in 1912, became "ex officio historian of the Association." Since then the office of the Historian went with that of the Editor of the *Journal* and became after the establishment of the Practical Edition in 1940 one of the incumbencies of the Editor of this more recent journal.

In a statement before the American Pharmaceutical Association meeting at San Francisco on August 12, 1915, Eberle characterized the part of the American Pharmaceutical Association Editor-Historian in the pharmaceutico-historical endeavor as that of "the conservator of historical contributions."[2]

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[1] Proc. Am. Pharm. Assoc. 52(1904): 428.
[2] Journ. Am. Pharm. Assoc. 5(1916): 242.

Even this limited task is a burden upon some one occupied with a number of duties. On the other hand, it is understood that the conservation of historical contributions represents only a part of the work to be done in order to give to the history of pharmacy the same care, hence the same importance and value, that has been given to the histories of other sciences and professions, especially to the history of medicine.

At the end of 1940 the Section on Historical Pharmacy was the only one of the sections of the American Pharmaceutical Association that was not supplemented by a separate institution devoted to the permanent and consistent care of the special field concerned. When, on January 22, 1941, a permanent working center for historical pharmacy, the American Institute of the History of Pharmacy, was founded at Madison, Wisconsin, this gap was closed. The Institute became an affiliate of the American Pharmaceutical Association in March, 1942.

This morning marks a new turn in the pharmaceutico-historical movement in this country. For the first time the American Pharmaceutical Association Section on Historical Pharmacy and the American Institute of Pharmacy have joined forces. They certainly will continue to do so, the Section offering the wide repercussion and the connection with pharmacy on the whole which only an all comprehensive organization makes possible, the Institute warranting the consistency of planning and work and the mutual assistance and education to expertise based on permanent and systematized devotion to one special task.

As a matter of fact, the American Pharmaceutical Association Section on Historical Pharmacy and the American Institute of the History of Pharmacy are nothing but the two sides of the same medal. Only if the stamps on both sides are referring to and supplementing each other, the medal can be regarded as perfect and meeting the purpose for which it was coined.

The History of Military Pharmacy in the United States: A Progress Report*

RALPH BIENFANG
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Pharmacy's anomalous position in World War II is responsible for the crystallizing of what was previously only a curious interest into what is now a thoroughgoing and purposeful study on my part. Minor bibliographic research conducted in 1942 to substantiate pharmacy's attitude toward the Pharmacy Corps bill opened up such fascinating avenues and bypaths that, to me, there is now no stopping, short of a properly documented published work.

When this realization was reached, Dr. George Urdang of the American Institute of the History of Pharmacy was written, and he immediately proffered his encouragement and willingness to help. He still continues in this offer, and it is my sincere hope that the eventual work will not disappoint him.

To make a study of this kind, one which involves the tracing of an entity ordinarily not categoried or spoken of, it became necessary first of all to develop a fixed concept of what constitutes military pharmacy. To put it briefly, military pharmacy is being considered as medical supply to the armed forces. So, research is being conducted on supply tables, on carrying gear, on uniforms and special markings, and on personalities in the supply service.

By way of getting started, one of the initial things that was done was to send out the following appeal, both to the pharmaceutical press, and to selected historical societies over the country:

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* Presented before the joint meeting of the Section on Historical Pharmacy of the American Pharmaceutical Association and the American Institute of the History of Pharmacy at Pittsburgh, Pa., on August 28, 1946.

HISTORICAL INFORMATION WANTED ON U. S. ARMY PHARMACISTS, U. S. NAVY PHARMACISTS, AND U. S. MILITARY PHARMACY

The American Institute of the History of Pharmacy has graciously invited me to write a History of Military Pharmacy in the United States, and this I intend to do.

Much wonderful information for such a history has already been discovered in available documents, and more will be sought. But as is always true of any history, much about military pharmacists and military pharmacy has never been recorded.

It is for the purpose of obtaining the latter sort of information particularly, that this appeal is being made. Will readers who

ARE MILITARY PHARMACISTS OR MEDICAL SUPPLY OFFICERS;

HAVE BEEN MILITARY PHARMACISTS OR MEDICAL SUPPLY OFFICERS;

ARE RELATIVES OF MILITARY PHARMACISTS OR MEDICAL SUPPLY OFFICERS;

HAVE FORBEARS WHO WERE MILITARY PHARMACISTS OR MEDICAL SUPPLY OFFICERS;

POSSESS INFORMATION ON MILITARY PHARMACY, or

KNOW SOURCES OF MILITARY PHARMACY INFORMATION

please communicate with me?

A worthy history of military pharmacy in the United States is much to be desired. Will you help to bring it into being and to make it as complete as possible?

RALPH BIENFANG
University of Oklahoma

The results from this appeal were quite disappointing. One historical society even turned my letter over to a phar-

macy dean whom of course I could have written direct had I desired to bother him.

Letters to heirs of personalities likewise for the most part have fallen upon sterile ground ... with one notable exception ... one reached a descendant of Andrew Craigie, George Washington's Apothecary General. An extremely satisfactory correspondence has been carried on with him. In both the blanket appeal and the personal approach it seems necessary to uncover a fellow spirit—and I know of no method except chance for accomplishing that.

Willing help has however been received from the National Park Service, and the National Archives at Washington has proved a rich source of documentary photographs. Among others, there have already been assembled, photographs of a medical supply wagon (Union, Civil War), of the hospital stewards of the 2nd Division, 9th Corps (Union, Civil War), and of the pharmacy on Admiral Dewey's flagship.

In connection with the study, a U.S.N. Hospital Corps song was written and published in 1944, and a U.S. Army Pharmacy Corps song composed and printed in 1945. Also several short articles have been published in the pharmaceutical press. In natural consequence, a collection of bibliographic items is being added to the University of Oklahoma School of Pharmacy Library. Notable among these is BROWN, H. E., *Medical Department of the U. S. Army,* 1775 *to* 1873. Furthermore, a Military Pharmacy Museum has been established at the university. One of the rarer pieces in this museum is a Dr. E. R. Squibb ether can from the Civil War.

The study has now arrived at a point from which it appears, two additional fact-gathering efforts remain necessary. There needs to be personal observation at the New York and other Medical Supply centers (if permitted), and on-the-ground bibliographic research must be carried on in Washington. These done, the work may go forward to completion.

Unlimited Enrollments; a Reality and a Threat

GEORGE E. CROSSEN
Oregon State College

In view of the large amount of lip- and pen-service rendered the topic during recent years, the latest enrollment figures released by the Excutive Committee of the Association prompts an analysis of enrollments for the purpose of determining the degree of limitation by the member colleges.

Any comparison of total enrollment is, of course, worthless for this purpose because the official reports of the several years were compiled from figures obtained from varying numbers of schools. Therefore, an average enrollment per school was calculated, and this figure used as basis of comparison. The results, eliminating the lean years of the war, are as follows.

School Year	Average Total Enrollment
1937-38	120
1938-39	129
1939-40	140
1940-41	143
1941-42	125
1942-43	105
1946-47	226

The number of new students admitted to this same average member college during the same years was as follows.

School Year	Average New Enrollment
1937-38	42
1938-39	47
1939-40	50
1940-41	50
1941-42	34*
1942-43	28*
1946-47	96*

**Freshmen only*, total new students not available.

A brief scanning of these figures suffices to show that the average school of pharmacy today has an enrollment almost twice that of the highest previous period, and that the present number of freshman students is almost double the total of *all new students* admitted during the same year.

One cannot refrain from wondering whence has come the extra faculties and facilities needed to adequately process these numbers. Neither can one help wondering what will be done when the present large numbers of underclassmen advance to the upper classes where they will demand more attention in the professional studies.

It is considered by some that this latter point is unimportant. These will point to "normal" student mortality figures, thus proving (or deluding themselves into believing) that academic survivals will be in line with facilities. However, they neglect the fact that the veteran is not a "normal" or "average" student in the pre-war sense. They seem to forget that he has exercised a four or five-year more matured judgment in choosing his vocation, and that he is, in the main, a serious and hard-working individual who is anxious to get the preparatory hurdles behind him in order that he may begin the so long denied business of leading a normal life.

It is probably true that every school is looking forward to an enlargement of its physical plant. It is possible that some already have funds set aside for this purpose. However, materials and skilled labor become an important consideration, so much so that some institutions are now resigned to a lag of five to eight years in their building programs. If this is a true picture, what happens in the meantime?

One of the things that can and quite probably will happen is a curtailment of laboratory classes since it is here that the pinch is most severe. One might argue that such curtailment affects only the training of the student; that his education will not be impaired. To those of us who consider their laboratories as educational tools designed to lift principles from the text book and apply them to specific and practical cases, such a revelation is disconcerting, to say the least. Further, if

laboratories are not needed in some schools, then why not dispense entirely with this expensive and time-consuming luxury, bringing all curricula into accord?

The answer, of course, is not that laboratories are unneeded, but is rather that education must be curtailed in the interest of expediency or to save the face of the near-sighted administrators. When and if that comes to pass, educational standards will have been lowered, incompetents will be permitted to enter the field, and the profession will have been sabotaged by those whose duty it is to guard the portals of entry.

The figures cited indicate that we face a critical situation, a dilemma which must be solved, and quickly, if pharmaceutical education is not only to fulfil its function but to advance to meet future demands and challenges. It is inconceivable that the several schools and colleges, with their unexpanded facilities, their admittedly inadequate faculties, and their worn-out, obsolete and obsolescent but irreplaceable equipment, should be able to withstand the impact of an enrollment almost double that which formerly taxed many of them to capacity.

If the profession is to be served, if limitations are to be invoked, let us begin NOW, before the structure begins to crack under the strain of uncurbed pressure. We lose nothing by establishing logical barriers against an indiscriminate flooding of our colleges except, perhaps, the vain glory of administering or being associated with "big" schools; we lose everything if we fail to set up such buffers against a demand which is at least partially artificial.

Now is the time to impose limitation of enrollments based on school capacities and actual rather than fancied demands of the various sections. Some of the colleges have already done this. All should realize its importance and begin at once their plan of screening. To neglect or postpone this actoin is to fail in an important duty to the student, the profession and the public; a duty that seems to be recognized by all except a comparative few upon whom it rests.

Editorials

The Prospects For Pharmacy Under the Medical Service Corps*

Considerable discussion is developing concerning the pros and cons involved in the question of Pharmacy Corps versus Medical Service Corps, and to a certain degree the subject has been pretty well thrashed out. However, in many cases this discussion has confined itself to the consideration of immediate opportunities under the alternative plans and has not considered at any great length the long range possibilities of each of the plans which have been considered.

There seems to be little doubt from information which has come from a number of sources, that if the Pharmacy Corps Bill is forced upon the Surgeon General against what he has definitely stated are his wishes and better judgment in the entire matter, and against what now seems to be the opinion also of the General Staff, Pharmacy as a Profession could then look to retaining the honor of the separate corps in the regular Army with its seventy-two appointments and would probably have to very shortly realize and accept the fact that this would be the maximum which it could anticipate as its assigned part in either a peace time or war time army which might later be required. Therefore, under this scheme, any of our present or future graduates who might be called upon to serve with the military forces of this Nation, and who had not already been "placed" in the group comprising the Pharmacy Corps of the Army, would have to look forward to the same situation in the future which faced all of the pharmacists in the last war, namely, that of starting from scratch and working up to the responsible positions which they later occupied in many instances, and would also have to realize that many of the opportunities which did exist in the past war by virtue of the presence of the Medical Administrative Corps,

* This editorial is the result of a discussion between Dr. Kidder and Surgeon General Kirk on the Medical Service Corps question.

might also be lacking because of the termination of that particular branch.

In contrast to that, let us consider the well nigh "geometric progression" which is involved in the scheme now proposed by the Surgeon General under the new Medical Service Corps and with which it is planned to make use of all the smaller groups of professional individuals which have been and would be required to maintain the optimum care of the military sick and injured in the future.

The exact size of the medical service corps cannot yet be estimated due to the difficulty of determining the size of the peace time Army. However, a rough estimate of the proportion of individuals who might as pharmacists serve in such a corps in various capacities has been determined.

It is contemplated that approximately 18% of individuals assigned to the Pharmacy Service Corps would be engaged in strictly pharmaceutical work and would have to be graduates of approved courses in colleges of pharmacy. However, this same type of graduate would probably be best fitted for the assignment required in medical supply activities which are estimated to comprise thirty percent of the Officers assigned under the Medical Service Corps. As many as an additional ten percent might be required for activities now carried out by the Sanitary Corps. Therefore, under this arrangement the possibility exists that over fifty percent of the vacancies which might occur in the proposed Medical Service Corps under the peace time Army set-up could possibly be filled by pharmacy graduates and there is no denying that their training is probably the best available for the various assignments mentioned under the categories noted above.

However, the comparison does not end here as the Surgeon General has definitely indicated that if his program for the Medical Service Corps is successful he will recommend the establishment of R.O.T.C. units in the various colleges having the necessary facilities and thereby make available to the properly qualified individual the Reserve Commission

which will not only guarantee him the proper use of his education and training but will assure him an acknowledgment of that training and responsibility by conferring upon him a commission. Thus the future of many pharmacists, and not a relatively small group, would be protected under the program which is now proposed by the Surgeon General under his plan for the Medical Service Corps and this in more than a limited sense which might be implied in the potential consideration of the "next" war, for if the activities of the Reserve Officers Association for retirement legislation are successful these Reserve Officers of the Medical Service Corps will be able to benefit by even the peace which their efforts and activity will serve to maintain.

Never before has Pharmacy been presented with such an opportunity by the Medical Department of the United States Army. To obtain it may require a cost which seems at the moment to be one of major proportions, namely, the loss of the hard won "Pharmacy Corps." However, in the long run it may very well be worth it especially to the many individuals whose future, militarily speaking, will be protected for years to come whether in war or peace.

JAMES H. KIDDER,
Fordham University.

Should Faculty Members Be Required to Work As Registered Pharmacists

The advancements in the medical science during the last decade have been stupendous. Some techniques and methods in this field have been completely revised or replaced. Likewise in the allied profession of pharmacy this metamorphic progression is occuring.

We as educators realize that a dynamic system signifies progress and innovations. Likewise, a static system implies decadence, retrogression and inertia. If we are merely "hold-

ing our own" — accomplishing the same each day and each year — we fall in the latter category. Thus our choice is either one of advancement or regression.

The willingness of pharmaceutical educators to constantly revise their curiculum is a healthy sign. We feel thoroughly justified in adding newer scientific courses in pharmacy. Outmoded courses are eliminated (with reluctance). The requirements of faculty members are constantly being elevated. Finally we will have attained that lofty perch whereby our staff is manned by a "brigade of Ph. D's." The ideal of raising our standards with the best trained men in their respective fields is a step in the right direction. However, we may be loading the ship too heavy on one end. The result is an uneven keel in our ship. The tendency in pharmaceutical education today is in that direction. Are we desirous only of having our faculty the best trained men in the scientific field and a group of "walking encyclopedias?" If so, we are apt to load too heavily on one end and are overlooking a simple remedy—practicality.

How can we as educators be practical? We desire to train the future pharmacist as a consultant to the physician. We desire to make him a specialist in the art of compounding as well as one proficient in pharmacology, pharmacy manufacturing, pharmaceutical chemistry, biologicals, etc. We expect him to know *why* he performs as well as *how*. This is as it should be. However, many of us fail in our most vulnerable spot—the practicality of all this to the average retail pharmacist. Why not apply the adage "practice what you preach?" It is with this thought in mind that the following proposal is suggested:

ALL FACULTY MEMBERS OF THE COLLEGES OF PHARMACY SHOULD BE EMPLOYED AS REGISTERED PHARMACISTS IN AN ETHICAL PHARMACY A MINIMUM OF 150 HOURS YEARLY. It would be preferable that this time be obtained by four consecutive weeks of full time employment. The problem should offer no difficulty for the

ten-month faculty member. For those employed on a twelve-month basis some provision should be made whereby they would obtain this experience. In this manner we would be cognizant of the trends in the retail drug store. We would have first-hand experience in the practice of our profession and not merely relate what should be done. We would have a grand opportunity of studying ways and means of promoting our professional aspects. We should thus be able to make the profit motive compatible with professionalism.

What specific advantages would this proposal hold in store for us? The following discussion will enumerate a few.

1. Our lectures and experiments could be supplemented with actual experience. The student is justified in asking, "when can we use that in the drug store?" From practical experience we should be able to truthfully and frankly answer his interrogation. Suppositions will then be reduced to a minimum.

2. Our active participation as registered pharmacists would promote good will between educators and retail pharmacists. In many instances a wide gap exists between the two. Some faculty members have never worked in a drug store; others in the nostalgic past. By working with the retail pharmacist and confronting some of his difficulties, better mutual understanding of each others respective problems will be attained.

3. We should be able to prove to many retail pharmacists that his prescription department is the foundation of his store and is profitable. We should be able to show him by actions that his primary interest should be the promotion of his professional aspects; that this will result in more net profits and add to the prestige of his establishment.

4. It should make us educators aware of the highly competitive nature of the retail drug business. We should realize that merchandising is a necessity for the average retail pharmacy. Even though the soda fountain, news stand, candy and

cigar counter, hardware and appliance department, etc., may be obnoxious to us, we might possibly assist the druggist in having his store symbolize professionalism and still retain his varied departments.

5. We should be able to show the pharmacist that his logical place in the professional field is as a consultant to the physician. We might be able to accomplish this by detail work for the druggist while in his employ. We should be able to prove to him that the training we supply the student in pharmacology, isotonic solutions, biologicals, etc. is practical. Thus the increased ringing of the cash register in the prescription department should be convincing proof that the fruits of his education should be primarily devoted towards that department.

6. And most important it should be our duty to be familiar with the problems confronting our students since approximately 90 per cent of them enter the retail field. The student eagerly looks to us for leadership and guidance. He has devoted faith in our teachings until he finds after leaving our fold that many of our statements have no logical basis in the retail field. Is hypocrisy advisable in pharmaceutical education?

LEO A. SCIUCHETTI,
Oregon State College.

INDEX TO VOLUME X

The index for Volume X goes out with this issue. For the tenth time it represents the work of Prof. Zada M. Cooper who for the best part of two decades was the secretary and treasurer of our association. Since her resignation from the faculty of the State University of Iowa she has lived in her home town of Villisca and has continued her interest in and service for the association, by compiling the index annually. This time it was a particularly tedious and difficult task because of the recording of two annual meetings in one volume. For her service and her sustained interest we are grateful.—Editor.

The President's Page

In my installation address* I suggested changes in admission requirements for our Association and recommended that the Committee on Revision of Constitution and By Laws rewrite Article I of our By Laws (covering admission requirements) in accordance with my suggestions. The results of their work will be published in the April issue and should be carefully studied by all member colleges.

In the 1946 report of the Chairman of the Executive Commitee** he points out that "there has been considerable discussion concerning the functions of the American Association of Colleges of Pharmacy as distinquished from those of the American Council on Pharmaceutical Education." He further states, "It is our opinion that the American Association of Colleges of Pharmacy is the educational association for pharmacy designed to directly promote and improve the educational process by assisting the individual colleges to constantly improve .... their educational programs .... Again it is our opinion that the American Council on Pharmaceutical Education is the accrediting agency for pharmacy. It's primary function is to determine whether or not individual colleges meet the minimum standards and requirements set up as criteria for this purpose."

I agree with this statement and I believe that neither group should attempt to fulfill the function of the other. Article I of our By-Laws is almost identical with the standards and requirements for accreditment of the Council and by retaining it in its present form we are duplicating the work of the Council, a well-established accrediting agency of which we are one of the sponsors. Before the Council was established there was some justification for having such extensive admission requirements, as were then serving to some extent as an accrediting agency; but at present it can only cause confusion and loss of prestige for pharmacy for two different organizations to attempt to do the same job.

* Am. Journal of Pharmaceutical Education, Vol. 10, p. 438—Oct. 1946.
** Am. Journal of Pharmaceutical Education, Vol. 10, p. 473—Oct. 1946.

I do not believe that every college of pharmacy should be admitted to membership simply upon application; but under the revised Article I sufficient check would be made of an applicant college so that the member colleges could determine whether or not they desired to admit a new school to membership. Certainly the detailed information now required is not necessary.

Under these new requirements for admission it is likely that we might have as members some schools that had not completely fulfilled all requirements for accreditment, but would not such schools be better able to work toward accreditment as members of our Association than as outsiders? Would our Association suffer from having them as members? Would not the instruction at these institutions be likely to be better under the wing of our Association than without our guidance? And would we not be fulfilling the proper function of our Association as defined by the Chairman of the Executive Committee in a better manner under the new requirements for admission?

At the next meeting of our Association this change in By-Laws will come up for a vote. By April 15th the revision must be mailed to all member colleges. If you have suggestions regarding it, I am sure the Chairman of the Committee on Revision of Constitution and By-Laws (Dean J. B. Burt of Nebraska) will be glad to receive them as soon as possible. If they seem to a majority of the committee to have merit, they may be incorporated in the revision of the By Laws before it is sent out to member schools on April 15th.

I sincerely hope that the proposed change in Article I of our By Laws will receive the approval of our Association at the Milwaukee meeting.

HENRY S. JOHNSON.

Renewals for the 1947 Journal are now due. The annual subscription rate has been increased by action of the Executive Committee to $4 to help cover the increased cost of production. If you will send your check at once to Secy.-Treas. Clark T. Eidsmoe, South Dakota State College at Brookings, you will save him needless labor and the Association money.

The Editor's Page

No name has ever been given to any special issue of the Journal other than "The Program Number" or "The Proceedings Number." Many times the Editor has been tempted to do so in order to emphasize a subject of unusual current significance. Through the first decade of the Journal's existence he has refrained from setting such a precedent. But the setting of a precedent might be a justifiable procedure at the beginning of the second decade of the Journal's life, especially since we are challenged by a future pregnant with possibilities and opportunities never before equalled or even approached in pharmaceutical history.

What these possibilities and opportunities are can be appreciated only by a perusal of the papers, the products of many minds, printed in this issue. After they have been read, the reader can appreciate the Editor's dilemma in choosing a name for the January issue, whether to call it "A Pharmaceutical Engineering Number," or "An Inspirational Number," or "A Pharmaceutical Horizon, Unlimited, Number." It ended by the use of all these titles. They are appropriate. This issue reveals the importance of pharmaceutical engineering in relation to industry, the limitlessness of the field of pharmaceutical possibilities that lies ahead and the vastness of it is challenging and inspiring. It is time for old men who have visions and young men who dream dreams to activate them.

In his presidential address at the Pittsburgh meeting Dean Glenn L. Jenkins called attention to the fact that pharmaceutical education is in new hands. He points out that within the year, twelve deans, either because of death or retirement, have been replaced by younger men. In addition three new colleges have been established with younger men in administrative positions. Since that address was written there have been at least two more changes in administrative positions and there are several others in the offing. Since the turn of the century pharmaceutical education has been passing

through the pioneering stage. It is now for the new leadership to build upon the foundation that for them has been pretty well laid in spite of the fact that there may be a soft brick or a batch of poor mortar here and there. As I run over this list of new deans I find that I can count everyone of them my personal friends. I wish to remind them that before most of them were born I made the statement that what pharmaceutical education most needs was a funeral of a lot of deans. I was speaking of my friends too in general and of myself in particular. No one ever held any ill will toward me because of that statement because while it may have hurt, we all knew it was true. That time has come and the responsibility for pharmaceutical progress rests upon new leadership. I am confident that leadership will not fail.

Although the Pharmaceutical Syllabus is a thing of the past as a measuring stick for the accreditation of colleges and as an absolute requirement for the pharmaceutical curriculum the spirit of the Syllabus still lives and it is just as virile as ever. I have discovered that some people don't know that The Syllabus represents the collective thought and experience of the best minds in American pharmacy over a period of four decades. It organized pharmaceutical education and made possible the coordination and integration of the work of educators and those administrative offices who are responsible for determining the qualifications of persons who apply for licensure. Beyond this the Syllabus Committee performed a basic function when it showed what subjects were fundamental in the pharmaceutical curriculum as we now have it and the approximate amount of time allotted to each.

These facts have not been changed and cannot be changed by any act of the American Association of Colleges of Pharmacy or the American Council on Pharmaceutical Education anymore than the fact that the intoxicating effect of a liquor which is 10 per cent alcohol can be changed by the unanimous vote of the Supreme Court of the United States. The basic principles of the Syllabus have become so fixed in our mind as the best we have been able to produce that we no longer

think of standardizing a four year course in pharmacy as we now have it anymore than we would think of standardizing a course in beginning chemistry. Everyone knows what a course in beginning chemistry should be.

Another discovery I have made in recent months is that some facultives seem to think that something is the matter with the present pharmaceutical curriculum and they have set out to do two things. First to "liberalize" the curriculum so that the student can specialize.

How can a student specialize before he has the basic training for specialization or even knows what the specialties are? That sounds like teaching a student the methods of teaching history before he knows any history. The second objective is to change the present pharmaceutical curriculum so he is prepared to do work on the graduate level when he has completed the work for the bachelor's degree. This attitude presupposes that the pharmaceutical curriculum as it now stands has a lot of subluxated courses in it. It might be well to add a chiropractor to our faculties to use his skillful thrust on these "subluxated" subjects to drive them into line and make them stick. The sooner we quit this pharmaceutical piddling and get down to realities the better it will be for the dignity of pharmaceutical education. There is no possible way that a student can be prepared for scholarly and creative work on the higher pharmaceutical levels by juggling the courses in the present undergraduate curriculum. As Dean Kendig in this issue of the Journal and on many other occasions has pointed out the trouble with pharmaceutical education is in the basement and until a lot of subjects now in the four year curriculum are dumped into the basement along with some other basic subjects, will it be possible to put into the four year undergraduate course those subjects which are essential for work on the higher level that the pharmaceutical engineer, the pharmacologist in industry and the research investigator and educator are pleading for. This is the task for the new leadership in pharmacy to bring to fruition.

If it is met and if we win, and I believe we will, we will no longer have to apologize for the lack of esteem in which pharmacy is held and pharmaceutical education and research will receive the moral and financial support which it needs and which its service so richly deserves.

The Pharmaceutical Survey marches on. We are printing from time to time "The Pharmaceutical Currents" as they appear from Dr. Elliott's pen. While the "Current" is addressed to The Pharmaceutical Survey Committee it is of equal value to us all because we are all eager to know the details of the procedure.

For many years our Association sought aid from the outside in an attempt to have a survey made. Our excuse was that a survey conducted from the outside would be more highly regarded because it would be free from professional prejudice. As a matter of fact the trouble was we did not know what to do or how to do it. It was a matter of great satisfaction then, as well as inspirational, when the American Council on Education accepted the willingness to conduct a survey and the American Foundation for Pharmaceutical Education was willing to finance it. It is not the policy of the Council to waste time and energy on problems that it does not consider worth while, and it is not the policy of the Foundation to waste money on a project that seems of little value. I think it is not an over-statement to say that one of the chief values of The Pharmaceutical Survey to the pharmaceutical educators is that it will show us how to apply scientific methods to the problems of education. The Survey will be of value to each of us in proportion to how well we learn that lesson. I am speaking out of a personal experience I had when I had a part in the Charters study of two decades and more ago. It took me ten years to realize the importance of that study and what it meant to me in an educational way but that was due to my dumbness and not to any fault of the Commonwealth study.

From here and there I have heard a complaint and sensed a little irritation at the conduct of The Survey. This

is to be expected in the conduct of a project of such magnitude. For a project of such coverage the irritation has been surprisingly small, in fact it is negligible. This is due to a very large degree to the fairness, the honesty, the openmindedness, the consideration given to others and the plain speaking of the Director of The Survey. There is a certain kind of man I like. Representative of that type is former Chancellor C. S. Boucher of my own University. Dr. Boucher always listened to what I had to say. He never, like so many men do, broke into my story. He was patient in his waiting. He never showed any signs either of irritation or ennui. When I was through he said what he thought. I could see he had weighed and evaluated my argument. He never minced words. When he was through I knew just exactly where I stood with Sam Boucher and I loved him for it. You will find Ed Elliott belongs to that class of men. He does not believe in wasted energy which may result from duplication. He is cooperating with every committee of our Association. He is cooperating with every pharmaceutical agency. He is seeking information and help from men engaged in every aspect of pharmaceutical activity, and I have my suspicions that he is seeking information from the man on the street. Be grateful to Ed Elliott if he expresses opinions which are contrary to your point of view. I am. If everyone agreed with me what would there be for me to write editorials about and if everybody agreed with my point of view what would there be to stimulate me to mental activity. Only when men see things from different angles is there progress. Let us continue to give Dr. Elliott every assistance we can in this monumental task. And let us not make it a thankless job. The Pharmaceutical Survey is an epoch making event in the history of pharmaceutical education. It deserves a position at the top of the list as one of the most important factors indicating pharmaceutical progress in 1946.

In a circular letter, under a December date, addressed to the more than 12,000 members of the American Pharmaceutical Association, Secretary Robert P. Fischelis calls attention to some of the outstanding pharmaceutical accomplishments

of the year 1946, that represent pharmaceutical progress. We print them here as a matter of record:

1. Expanding Pharmacy's public relations, including the development of Pharmacy Week as a supporting factor in national public health programs.

2. Establishing Pharmacy on a permanent professional basis in the Civil Service at salaries up to $6000 for pharmacists.

3. Developing commissioned rank for pharmacists in the Army, Navy and Public Health service up to the grade of Colonel and comparable rank in the Medical Division of the Veterans Administration.

4. Developing more active and effective cooperation with medical, dental, hospital and other health professions.

5. Sponsoring the first Hospital Pharmacy Institute in cooperation with the American Hospital Association and promoting the interests of hospital pharmacy in general through the American Society of Hospital Pharmacists.

6. Developing a program of uniform laws to govern all phases of pharmaceutical practice with special reference to the control of barbiturates.

7. Participation in the development of a World Health Program.

8. Publication of the new Eighth Edition of the National Formulary which becomes official April 1, 1947 and is now available.

But this is not the whole story of accomplishment. Dr. Fischelis has only tabulated some of the beacon lights along the way. In another letter addressed to the more than 300 life members of the Association, dated January 16, 1947, he wrote:

"To my mind, the great service which the American Pharmaceutical Association is able to render is due largely to the support of members like yourself who have either been active in the Association upward of 37 years or who have had enough confidence in the organization to pay a life membership fee somewhere along the course of their membership, indicating that it was their intention to be identified with our activities for the full span of their lifetime.

"Our Headquarters Building is now becoming crowded as we add new personnel and take over new activities. One of the most important of the new activities upon which we are now entering is the intensive support and promotion of hospital pharmacy. With the many new hospitals that are going to be organized with government aid in the near future, it is of great importance that hospital pharmacy be not neglected.

"Our relations with all of the government departments are improving constantly and we are being called upon more and more for technical advice and counsel by these agencies.

"We have also noticed a distinct trend toward greater cooperation among the various groups within the drug industry. It has always been the aim of the American Pharmaceutical Association to serve pharmacy in all of its branches and we are happy about the trend toward unanimity of opinion within the profession and the drug industry on matters of broad policy. This augurs well for the future."

In other words, the year 1946 has seen two objectives of pharmaceutical endeavor brought to fruition — objectives which at the turn of the century were not even in the dreams of the most visionary of men. One is the part pharmacy can and should play in our national life. The other is the solidarity of all phases of American Pharmacy which is now manifested in many ways. To one who has lived through four decades of turbulent pharmaceutical activity these results are an inspiration and they bring a wealth of satisfaction. For the younger generations that have not had this experience the only substitute to bring them the inspiration they need is the study of pharmaceutical history. This is a strong argument for making adequate courses in historical pharmacy a basic part of the pharmaceutical curriculum.

RUFUS A. LYMAN.

The University of Minnesota announces the following scholarships and assistantships available for pharmacy students for 1947-48: One American Foundation for Pharmaceutical Education Pharmacognosy Fellowship at $1,200, plus tuition and fees not to exceed $267.

Three Lederle Fellowships for research in Pharmaceutical Chemistry at $1,000, without exemption from tuition.

Not more than three $1,000 Samuel W. Melendy Memorial Fellowships, without exemption from tuition, to be offered annually. The major study must be Pharmaceutical Chemistry or Pharmacognosy, and full time must be devoted to graduate study and research.

One Parke, Davis and Company Fellowship in Pharmaceutical Chemistry at $1,000, without exemption from tuition.

Four teaching assistantships in Pharmaceutical Chemistry and two each in Pharmacognosy and Pharmacy ranging up to $788, with certain fee exemptions, provided 25% or more of full time is given to the University. Registration in the graduate school is required. Address the Graduate School.

Gleanings from the Editor's Mail

I have just returned from a fortnight of travel in the midwest, exploring some of the pharmaceutical trenches; and have this first opportunity of examining the October number of the Journal.

Certainly you are entitled to full congratulation for your complete coverage of recent events. In particular I want you to know how much I appreciate your extended attention to The Pharmaceutical Survey. Furthermore, I know I am indebted to you for your various personal references found on the editor's page. In passing, you may know that I am continuing to drift into many drug stores!

I hope at least three additional copies of the October Journal are available. If so, will you ask your secretary to send them to me.

Edward C. Elliott,
Director, The Pharmaceutical Survey

Washington, D. C.
January 22, 1947.

Thank you for sending me the October Issue of "The American Journal of Pharmaceutical Education." You are to be congratulated for your industry, foresight and vigor in continuing with so worthwhile an enterprise. In the very near future I want to read Dr. Elliott's articles as I have been associated with him during the war days when he was concerned with manpower problems.

Harold C. Lueth, Dean,
College of Medicine

University of Nebraska,
January 14, 1947.

There is a limit to the number of students that any school can handle and do a good teaching job. The teaching staff and physical plant has its limits. This limit should be determined and held to by the association. If an institution staggers classes morning, noon and night in order to accommodate numbers we know that they will deteriorate to "plugging course" days, not too long past, with disastrous results to the standing of pharmacy as a profession. There should be no let down in either quality of students or teaching. The lean years of some of the schools will see this as a hey-day for making money.

I fear if no check is put on this when the depression comes, as come it will, pharmacy over-manned will take a terrible licking. We may lose all we have gained in the past 25 years.

Wilbur J. Teeters,
State University of Iowa.

A great deal of interest is developing in Hospital Pharmacy as a field of endeavor, but little has been done toward planning a definite curriculum for this field or for giving a place to it in the pharmaceutical curriculum. Of course, the A.S.H.P. has been saying a great deal, but little response (it seems to me) has been received from the A.A.C.P. I wonder if it might not be a good idea to have a discussion of this subject in one of the conference meetings next year. Perhaps the conference of Teachers of Pharmacy (for example) could discuss the topic "The Place of Hospital Pharmacy in the Pharmaceutical Curriculum"—or "A Curriculum for Hospital Pharmacy."

Joseph B. Sprowls

University of Buffalo,
October 9, 1946.

CANSEJO NACIONAL DE TUBERCULOSIS

Habana, Cuba
October 26, 1946

The American Journal of
Pharmaceutical Education
Lincoln, Nebraska.

Dear Sirs:

We are taking the liberty of asking you if you would kindly exchange your Journal, booklets, charity stamps, etc. with our publications.

We hope that our offer will be appreciated and that you will send us in exchange your last publications.

Awaiting your reply and thanking you in anticipation, we remain, yours faithfully.

Dr. Ernesto Bello,
Director Bureau Propaganda
Cansejo National de Tuberculosis
Ave. Columbia y Octava,
Marianao, Habana, CUBA

THE HEBREW PHARMACEUTICAL
ASSOCIATION OF PALESTINE

Tel-Aviv, Palestine
22nd September, 1946

Mr. R. A. Lyman, M. D.,
Dean of College of Pharmacy.

Sir:

We are greatly interested in your article on "Romance of Pharmaceutical Education" in the Squibb Memoranda issue of December last and would be very obliged to you if you kindly send us a specimen of the American Journal of Pharmaceutical Education.

Same would be of great help to us in connection with our recent educational drive and its early receipt would be highly appreciated.

Yours faithfully,

F. Buerger, Secretary.

J. Yellin, Chairman

Across the face of the statement announcing the increase in rate to $4 Prof. Eidsmoe sent Dr. Robert L. Swain for the 1947 Journal, Dr. Swain wrote the following line so characteristic of him:

Well worth the NEW PRICE!
SWAIN.

(This note is printed in appreciation of Dr. Swain's ever loyal support to this Journal.—Editor.)

AMERICAN FRIENDS SERVICE COMMITTEE
Philadelphia, Pennsylvania

Dear Editor:

Re: 15348
Eller, Paul

Last September you very kindly wrote that you would place in the October issue of the American Journal of Pharmaceutical Education a notice concerning Dr. Barkan.

In January Dr. Howard B. Lewis of the University of Michigan sent us information which enabled us to learn that Dr. Barkan is now deceased but his widow is still living.

We wish to express our appreciation of your cooperation which made the conclusion of this case possible.

Mary S. Cunningham
Foreign Service Section

February 14, 1947

Notes and News

University of Buffalo, School of Pharmacy.—During the last semester, a seminar course has been provided for senior students. Topics have been chosen on the basis of their current interest or special value to the student. Experts from all fields have contributed generously to the programs. Local retailers have been invited to the programs and they have attended regularly. Discussions for October centered around current trends in pharmacy and state board of pharmacy problems. During November the topics were of a scientific nature, dealing with the anti-histomine drugs and streptomycin. During December, public health problems were discussed. The January programs were again of a scientific nature, dealing with wetting agents, folic acid, and the thiouracil drugs.

Butler University, College of Pharmacy.—Plans for the pharmacy building are being completed as rapidly as possible. Present estimates indicate that the building will cost considerably more than one-half million dollars. It will be two hundred and twenty-five feet in length with a width of seventy feet and will have three floors, and a basement which can be used for college purposes. The structure will be built of limestone and granite.—All members of the faculty of the former Indianapolis College of Pharmacy have been retained by Butler University, and several new members have been added.—Since the merger, courses in English, American history, mathematics, economics, and other subjects have been given to pharmacy students by regular members of the staff of the College of Liberal Arts and Sciences.

University of Connecticut, College of Pharmacy.—The twenty-first school year of the University of Connecticut College of Pharmacy opened on September 30 with the largest enrollment in its history, the total registration exceeding two hundred.—Miss Margaret Adams was given the prize for general excellence in the freshmen year and was also awarded the Alpha Zeta Omega Fraternity Prize for excellence in biology.—The following additions and changes have been made in the faculty: Norman LaFayette, a graduate of Bates College with a Master's degree from George Washington University, has been appointed instructor in chemistry; Bertram Yood replaced William J. Strange as instructor in mathematics and is a graduate of Yale University with a Master's degree from the California Institute of Technology; Miss Mary Postizzi replaced Chester Potrepka as assistant instructor in chemistry and physics; Miss Naomi Rudnick replaced Reginald Marini as assistant instructor in pharmacy; Charles Robinette, a graduate of Niagara University is assistant instructor in chemistry and physics.

Duquesne University, School of Pharmacy.—The Pittsburgh Branch of the A. Ph. A. held the first meeting of the year at Duquesne. Dean H. C.

Muldoon gave a brief report of the Pittsburgh meeting held in August and Dr. Edward P. Claus of the University of Pittsburgh School of Pharmacy, who had spent a year teaching in the University of Puerto Rico, spoke on the subject "Pharmacy in Puerto Rico." He showed also kodachrome slides of some of the drug-yielding tropical plants growing in the medicinal plant garden of the College of Pharmacy.

Ferris Institute College of Pharmacy.—Mr. Byron J. Brophy, University of Michigan, has been appointed president of the Institute to succeed Dr. Merle S. Ward who resigned recently.—Mr. Ralph M. Wilson, dean of pharmacy, has been made dean of instruction and Mr. Roland G. Healy has been appointed assistant dean of pharmacy.—New additions to the faculty are Dr. David C. Sayles, Purdue university, as head of the chemistry department; Winnifred Moore, University of Michigan, instructor in chemistry; Taylor McCain, Kansas and Denver universities, and Richard Coward, Ferris Institute, instructors in pharmacy; Elinor Hoeflin, State University of Iowa and of Michigan, instructor in mathematics; George Wells, Michigan State College, head of department of bacteriology; Caroline Hendricks, Clemson College, instructor in botony and zoology; and Caroline Stearns, University of Michigan, instructor in English.—Four additional laboratory tables, to accommodate 56 more students, have been installed in the pharmacy laboratory and two additional laboratory tables have been purchased to serve 48 more students in chemistry.—The present enrollment in pharmacy is 286.

University of Florida, School of Pharmacy.—Florida May Carlson and Lewis L. Bohannon are the recipient for the current year of the American Foundation for Pharmaceutical Education scholarships.—The William Emrich prize for scholastic work in the junior year was awarded to Sheldon M. Spector.—The President of the Florida State Pharmaceutical Association has personally presented memberships in that organization to all senior students.—Dr. Paul A. Mattis spoke recently before the local chapter of Sigma Xi on Research on the Sulfonamides.

Fordham University, College of Pharmacy.—Dean James H. Kidder has accepted the position of Associate Clinical Professor of surgery in the New York Medical School. He has also been appointed as Consultant in Pharmacy to Surgeon General Norman T. Kirk.—Dr. Leonard J. Piccoli has been awarded the "Bene Merenti" medal in appreciation of twenty years of service.—Dr. Justice B. Rice, director of medical research of the Winthrop Chemical Company, recently addressed the alumni association on the subject, "The Present and Future of Antibiotics."—When the University inaugurates, in April, its radio station FM, the College of Pharmacy will give weekly programs by faculty members and prominent men in related fields.—A Spiritual Retreat was held for the pharmacy students in December. The exercises for the Catholic students were conducted by Rev. Charles F. Conners and for the others by Rev.

E. Paul Amy.—The faculty and senior class recently visited the Hoffmann-LaRoche Laboratories at Nutley, New Jersey.—Leonard Berger, president; Arnold Lentz, vice-president; Grace Phillips, secretary; and Birdie Henry, treasurer, are the recently elected officers of the Student Branch of the A. Ph. A.—Misses Norma Truda, Josephine Caminos, Jean Sheridan, Jackie Tumber, and Theresa Friscia were pharmacy students who took part in a recent general University play.

Massachusetts College of Pharmacy.—During the convention of the American Association for the Advancement of Science, held in Boston in December, the National Science Teachers Association, an affiliated organization, held its meetings at the Massachusetts College of Pharmacy. Eldin V. Lynn, chairman of the department of chemistry, presided at the meeting of the Physics Section. Maynard W. Quimby, assistant professor of botany and pharmacognosy, contributed a display of insecticides, rodenticides, and herbicides as a part of a general display of science teaching materials in George Robert White Hall.—Heber W. Youngken, chairman of the department of materia medica, presented a paper on the identification of cubeb at the meeting of the Pharmacy Section of the A.A.A.S., at the Hotel Statler.—Charles W. Bauer, associate professor of chemistry, was local secretary of the Pharmacy Section.—Eighteen students are registered in the Graduate School for the current session. Included in the enrollment are students from India, China, Norway and Switzerland.

University of Minnesota, College of Pharmacy.—The services rendered by the departmental library have been expanded through the addition of Mrs. Margaret Lehrer as a full-time clerk to assist Mr. C. E. Smyithe, librarian.—Myron R. Buchdahl of the University of Michigan, College of Pharmacy, was appointed as a graduate teaching assistant.—Virgil Magnuson, a senior student, was appointed as an undergraduate teaching assistant at the opening of the fall quarter last year.—The Tenth Continuation Study Course in Pharmacy will be offered to pharmacists of Minnesota and adjacent states on February 24, 25, 26.—Dr. Charles V. Netz attended a meeting of the Achievement Test Committee of The Pharmaceutical Survey on January 10-11 at the University of Illinois College of Pharmacy.—On November 19, 1946, in the auditorium of Wulling hall, Dean Emeritus Frederick J. Wulling delivered the Fourth Melendy Memorial Lecture in which he traced the development of pharmaceutical practice in Minnesota in the early days.—On October 22, 1946, Mr. J. F. Badgett, Special Representative for Merck and Company addressed the senior class on prescription department problems.—There are 348 students registered in pharmacy for the winter quarter.—Beginning with the fall quarter of 1947, admission to the professional work which begins with the sophomore year will be restricted to students who attained a C+ average during the freshman year.

University of Nebraska, College of Pharmacy.—An initiation of three students into Rho Chi Society was held in December. The new members are Hugh D. Bryan, Howard P. Jensen and Marvin W. Vollertsen. —Gamma Epsilon chapter of Kappa Psi was reactivated by the initiation of eleven students in January.—Grants in aid for research in the department of physiology and pharmacology have been awarded by the University Research Council.—One student was graduated at the end of the first semester.—A fellowship in the amount of $1000 for a graduate student pursuing work in pharmaceutical science has been given to the University of Nebraska Foundation by the Sioux Honey Association. This valuable award was made possible by work conducted during the last year by the department of pharmacognosy in cooperation with the University Chemurgic Department on several volatile oil bearing plants.

University of New Mexico, College of Pharmacy.—The pharmacy students participated in the homecoming parade with a float the motif of which was a mortar and pestle depicting a pharmaceutically-styled invitation to the New Mexico Lobos to rub out their ancient enemy, the Wildcats from the University of Arizona.—An all-pharmacy Christmas party was staged and a program given in which the students exhibited their extra-pharmaceutical talents. "The Apothecaries, the pharmacy students' club, has been holding its regular monthly meetings with programs consisting of professional talks and papers. The meetings are held jointly with the Albuquerque pharmacists. Dr. D. H. Roberts is the club's advisor.—The New Mexico Drug Travelers recently gave a contribution to the pharmacy scholarship fund which now has passed the $10,000 mark. In addition the college now possesses a special fund of 2,000 which was given by Dr. B. H. Briggs, Albuquerque pharmacist, for the purchase of pharmacy equipment.—Dean R. A. Bowers presented a paper recently on Protein Therapy before the New Mexico chapter of Kappa Mu Epsilon, national honorary mathematical society. In January he also attended the directors' meeting of the New Mexico Pharmaceutical Association in Albuquerque and was granted a New Mexico pharmacist's certificate by examination.—The pharmacy library now has more than 1000 volumes. This has been made possible by generous allotments and purchases by the University and by gifts from several national pharmacy and related associations and individuals from all parts of the country.—Dean Bowers was recently elected secretary-treasurer of Rho Chi.

University of North Carolina, School of Pharmacy.—A meeting was held at the School of Pharmacy on November 13 to organize District 7 of the North Carolina Pharmaceutical Association. After the business meeting, a program featuring the magic and ventriloquism of A. Coke Cecil, Pharmacist of High Point, was presented. Students were invited.—Dr. Edward C. Elliott, Director of The Pharmaceutical Survey spent two days in December in consultation with the faculty. Dr. H. M. Burlage

was appointed Consultant on Pharmacy by Dr. Elliott.—David W. Masengill, has been initiated into Rho Chi.—The Phi Delta Chi chapter was given space in the pharmacy building for its secretarial office. Organizations which already have their secretarial quarters here, are: the North Carolina Board of Pharmacy, the North Carolina Pharmaceutical Association, Rho Chi, Kappa Psi, Kappa Epsilon, the Pharmacy Senate, and the Pharmacy Girls Association.—The Student Branch of the N. C. P. A. has held three programs during the semester. They were: "Native Drug Plants of North Carolina" by W. J. Smith; "Pharmacy on the National Scene" by Congressman Carl T. Durham; and "Essentials of Window Display" by nine members of Phi Delta Chi. The latter program was the first of a series to be given by the members of five student organizations in competition for a twenty-five dollar prize awarded by the state association.—Through the cooperation of the faculty and the North Carolina Pharmaceutical Association the North Carolina Pharmaceutical Research Foundation was incorporated on December 17, 1946. At their first meeting the Board of Directors elected Prof. E. A. Brecht as secretary. Sufficient funds were raised to guarantee the budget for the first year, including the establishment of four graduate fellowships to carry a stipend of one thousand dollars each with additional funds for supplies, special equipment, and library source material.—Beginning with the fall quarter of 1947, there will be offered courses of study leading to a Doctor's degree. The Master's degree has been given since 1932.—A portrait of the late Dr. E. F. Kelly, secretary for 18 years of the American Pharmaceutical Association, was presented to the school by the North Carolina Pharmaceutical Association. Dr. Kelly was a native of North Carolina. The portrait was painted by Artist William Steene. Mr. John A. Goode of Asheville made the presentation and Mr. John R. Dargavel, secretary of the National Association of Retail Druggists brought a message from that association.

Ohio State University, College of Pharmacy.—Several former graduates of the college have been separated from the armed forces and are now continuing with graduate studies. Charles Bope, Willis Brewer, Melvin Chambers, George Curts, Carl Kelley, William Roberts, James Thigpen, and Joseph Zapotocky are serving as graduate assistants. Woodrow Byrum, Roy Darling, Anthony Ridolfo, and Joseph Zapotocky have been awarded fellowships by the American Foundation for Pharmaceutical Education.—Amin Abdel-Latif, a graduate and instructor in Fouad University, Cairo, Egypt, has enrolled as a graduate student with major in pharmacognosy.—Dr. J. E. Orr, who was separated from the Navy during the summer, has resumed his teaching duties as assistant professor of pharmacy.—The Prescription Laboratory has been remodeled with the addition of specially constructed, individual desks and several new pieces of equipment including a Schwarts cabinet, pressure sterilizer, storage room, supply desk and refrigerator. A Fenwall unit is to be installed as soon as available.—Eighteen new Model

No. 63E Spencer microscopes have been added to the equipment of the pharmacognosy laboratory because of the increased enrollment and the need of replacement of worn-out instruments.—The pharmacy students had their traditional annual Christmas party which began with a spaghetti supper and was followed by music and various entertainment features furnished by themselves. A Christmas tree fully decorated with gifts, after the part was over, was presented to a local orphanage which the students have adopted so that the children might have a part in their Christmas cheer. The first meeting of the student branch as the beginning of the New Year was addressed by Dean Brunner of the Commerce College who analyzed the duties and functions of a typical drug store with profit for the students.—The Ohio student branch of the American Pharmaceutical Association for a number of years have published a mimeographed sheet, "The Spur." Volume, No. 1 appeared in the autumn in booklet form, on good paper well illustrated, and worthwhile contents. It is well supported by local advertising The students are to be congratulated for this change and are setting an example that other students may well follow in producing a dignified publication.

University of Oklahoma, School of Pharmacy.—Dr. Ralph Bienfang has been invited by the Nassau County Tuberculosis and Public Health Association, Mineola, New York, to write an article on "What Are Drugs" for a symposium on "Newer Medicines" soon to appear in their official publication.—Don Balden, John Clark, and Thomas Lout have been initiated into Phi Eta Sigma, University freshman honorary society. —The thirteenth annual convention of the Oklahoma Pharmaceutical Association will be held on February 21.

Oregon State College, School of Pharmacy.— Through the generosity of the McKesson-Robbins wholesale house in Portland, the model drug store is being completely restocked. Old packages are being replaced, and the latest specialties and proprietaries are being added. The senior class in Drug Store Practices is doing the rearranging and price coding under the supervision of Prof. Leo Sciuchetti.—Dean George E. Crossen has been named a member of the executive committee of the Oregon State College Faculty Council. Prof. H. C. Forslund was elected as the School of Pharmacy representative for a three year term.—The North Pacific Branch of the A.Ph.A. has set a goal of $15,000 for their sponsorship of a drive for funds to purchase standard industrial manufacturing equipment for the manufacturing pharmacy laboratory. Over one-third of this amount has been collected to date. —An all-school pharmacy mixer, sponsored by Rho Chi, was held recently to enable the various classes to become better acquainted.— Dr. John W. Nelson has been appointed to a special committee of the faculty council to study the entire registration machinery and to make recommendations for improvement.—Beta Zeta Chapter of Kappa Psi initiated ten new members giving the chapter a membership now of

twenty-four actives.—Of the sixteen pharmacy students on the honor roll for the fall term, six won the distinction of maintaining a straight "A" average.—Rho Chapter of Lambda Kappa Sigma recently initiated five new members giving them a total of eighteen active members.—The pharmacy student mortality was about ten per cent during the fall term. This is a somewhat higher rate than that for the entire school.—Among new equipment recently received are an electrically heated steam-autoclave, two Lindberg hot-plates, a Cenco DuNouy-tensiometer, a B&L binocular microscope, two Gorrell & Gorrell multi-speed kymographs with extensions, two mono-drum kymographs, a kymograph-paper shellacing and smoking apparatus, and an electric precision oven.—The North Pacific Branch of the A.Ph.A. is sponsiring a refresher program for practicing pharmacists in the form of a two-day seminar to be held in Portland in March.

Philadelphia College of Pharmacy and Science.—Under the direction of J. Mervin Rosenberger, president of the alumni association, a drive has been started to raise funds to erect an Alumni Hall on grounds opposite the College building. The building will provide meeting rooms and recreational facilities for the students and administrative offices for the association. It is planned to dedicate the building to the men and women of the college who served in the recent wars. A "100 club" has been organized for those making a contribution of $100 to the project.—The final enrollment figures for the 1946-47 session indicate that 75 per cent of those attending are veterans.—With the return of the enrollment to pre-war levels many extra-curricular activities have been resumed. These include the publication of "The Undergraduate", "The Scope" and "The Sigma News" as well as the many athletic activities.—The one hundred and Twenty-sixth Birthday of the institution will be observed on February 3.—Three American Foundation for Pharmaceutical Education Scholarships sponsored jointly by the Foundation and the school have been awarded to Rosemary Reilly, Marion White and Charles Fenstermacher.—The annual business meeting of the Women's Alumnae Association was addressed by Lt. William Leinhauser of the Bureau of Police who discussed the timely subject of illicit traffic in narcotics.

University of Pittsburgh, School of Pharmacy.— The Perry Frank Bowser Memorial Plaque was unveiled and dedicated on January 14. The ceremony which was held in the Stephen Collins Foster Memorial Hall was beautiful in its simplicity. The plaque, dedicated to honor the memory of the pharmacy students and graduates, who gave their lives for this country during World War II, was presented by the Galen Pharmaceutical Society of Pittsburgh. It bears five names as follows: Perry Frank Bowser, Lt. A.A.F.; Elmer Bernard Deiss, Jr., Lt. (j.g.); John Daniel Grobe, 2nd Lt.; Robert Anthony Reitz, Ensign; William Slovick, III, Capt., A.M.C.

Purdue University, School of Pharmacy.—Prof. Henry W. Heine who served the War Production Board from March 1942 to August 1946 has returned and is teaching pharmaceutical economics.—Dr. Gustav E. Cwalina has been appointed assistant professor of pharmaceutical chemistry.—N. W. Merrick, a Purdue graduate, and Glenn J. Sperandio of the St. Louis College of Pharmacy are teaching the senior and junior courses in dispensing which were formerly taught by Prof. Harry L. Kendall who resigned last summer to enter retail pharmacy in Santa Ana, California.—Richard K. Mulvey, who served as a medical supply officer during the war, has been appointed an instructor in pharmacy.—Four recipients of the American Foundation for Pharmaceutical Education Fellowships are doing graduate work at Purdue.—The Alpha Zeta chapter of Rho Chi, in conjunction with the Chinese Organization, sponsored a banquet in November last, in honor of Dr. K. K. Chen, chief pharmacologist for Eli Lilly and Company. Dr. Chen spoke at the pharmacy seminar and before the Purdue chapter of Sigma Xi.—Enrollment for the fall semester was 286 undergraduate and 44 graduate students. The undergraduate enrollment was limited and many applicants were denied admission.—Dean Jenkins has been re-elected chairman of the Indiana Interprofessional Health Council.—Kappa Epsilon society was established last October with 22 charter members. Kappa Epsilon is now a local society, but in the near future it will petition the national pharmaceutical society for a charter.—The student branch of the American Pharmaceutical Association conducted a very successful membership drive early in November.

Temple University, School of Pharmacy.—Dr. Frank H. Eby has been elected grand regent of Kappa Psi. He succeeds Dean Emeritus C. Leonard O'Connell of the University of Pittsburgh. Dr. Eby was one of the charter members of the Beta Omega chapter when it was organized at Temple in 1930.—Dean H. Evert Kendig has been confined to his home the last month on account of illness. He is now improving nicely. Nevertheless, he has kept in close touch with school work and has continued to assist in the plans for a campaign to raise more than $1,000,000 for the construction of a new pharmacy building which is scheduled to be ready for occupancy next September. During Dean Kendig's illness, Assistant Dean Harry W. Mantz is carrying the administrative load.

University of Tennessee, School of Pharmacy.—Mr. N. R. Garner, Ph.C., LL.B., a retail store owner in Memphis, is giving the courses in pharmaceutical jurisprudence during the winter term. Mr. Garner is a graduate of the School of Pharmacy, is a member of the State Board of Pharmacy, and a vice-president of the Tennessee Pharmaceutical Association.—Ninety-two students were enrolled the fall quarter, 71 were veterans and 9 were women. One student was graduated at the quarter's end. The majority of the male students are sons of druggists.—The room housing the materia medica museum is being

remodeled to provide space for two lecture rooms.—The fraternities, Phi Delta Chi and Kappa Psi began pledging activities soon after the first of the year. Students are not pledged until after completion of the first quarter.—Dr. A. H. Musick has been appointed a member of the faculty council on "The Use of Motion Pictures". A more extensive use of visual education is contemplated.

Union University, Albany College of Pharmacy.— With the increased enrollment the fraternities and sororities have became more active. Phi Psi initiated eighteen new members during the fall semester. Phi Delta Chi has been reactivated and initiation will be held in the near future. Dr. John D. Dwyer has been chosen faculty advisor.—The tuition scholarships for 1946-47, offered by the Borden Company for scholastic excellence during the last academic year, have been awarded to Walter Singer and Mary E. Murphy.—The majority of students who left the college at the beginning of the war for service in the armed forces have returned to resume their studies.

Medical College of Virginia, School of Pharmacy.—Dean Rudd was forced to cancel an engagement with the retail druggists of Tidewater, Virginia, January 22, and a meeting with the American Council on Education in Washington, D. C., January 23-25, because of illness. He is recovering at his home.—Assistant Dean R. B. Smith was elected vice-chairman of the Committee on Graduate Study of the A.A.C.P. at the Pittsburgh meeting and Dr. Kaufman, chairman, of the Section on Historical Pharmacy.—Dr. Smith, addressed the Medical Society at Bedford, Virginia, in November, on the subject of socialized medicine. His address was widely quoted in the Virginia press.—Dr. Neuroth attended the meeting of the Medical Society of Virginia in October and presented the joint exhibit of the school and the state association, on Topical Penicillin Preparations.—Several new pieces of apparatus have been added in the pharmacy department.

State College of Washington, School of Pharmacy.—Mr. Elwyn Swetmann, prominent pharmacist of Seward, Alaska, has made a second contribution of $200 to be used for undergraduate scholarships in pharmacy at the State College. Other sources of grants for recent scholarship awards to undergraduate students have been the American Foundation for Pharmaceutical Education, the State Pharmaceutical Association and its branches, local Chapters of Rho Chi and Lambda Kappa Sigma, and the George H. Watts Memorial Scholarship fund.—The name of Dean P. H. Dirstine appears in the latest edition of Who's Who in America.—A grating spectrograph has recently been added to the equipment.—The student hospital has recently increased its services to the students, and the School of Pharmacy is operating the hospital dispensary service.—The library collection of Dr. H. A. Langenham of Mercer Island, Washington, has been acquired for the pharmaceutical library. The collection includes books, journals, and U.S.P. and N.F. Revision Committee notes and proceedings.

University of Washington, College of Pharmacy.—Stewart McCutcheon is the recipient of a $2000 American Foundation for Education Fellowship. He is working with Dr. L. Fischer on "A Phytochemical Study of Certain Marine Algae".—Paul Rasanen has been added to the staff. He is a graduate of Washington State College and divided his graduate work between the University of Nebraska and Purdue.—Dr. Louis Arrigoni is teaching a new graduate course in analytical methods which embraces the following subjects: hydrogen-ion control, colorimetry, fluorimetry, gasometric chemical analysis, composition of compounds, and chromotography.—Rudolph Perry, from the Massachusetts College of Pharmacy, is doing graduate work in pharmaceutical chemistry.—The student branch of American Pharmaceutical Association has 105 members. Dr. Fischer is the faculty adviser.—District Number 7 of the Boards and Colleges will meet on the campus of the University May 2 and 3.—For the first time the College will offer an almost complete list of courses during the summer school. The faculty will consist of Drs. Plein, Arrigoni, Youngken, and Fischer.—The following students were given American Foundation for Pharmaceutical Education scholarships: K. O. Van Krevelin, Rudolph Burnhoft, Richard Theiault, $100 each; Ruth Acteson, Ruth Stoll, Gloria Schwartz. Marjorie Oldenburg, $25 each.

Western Reserve University, School of Pharmacy.—An optional five year course is now being offered. The program embodies a two-year pre-pharmacy course to lay a better foundation for the three years of strictly pharmaceutical subjects. Under this plan the pharmacy student's load is reduced from 17-19 to 15 credit hours which is an average load in other departments of the University. This will enable the pharmacy student to engage in extra curricular activities which the University offers or to carry certain additional courses which will enable him to broaden his training. It will also allow entrance to some students who were refused registration because of crowded conditions.—Dr. John B. Data, University of Michigan, has been added to the staff of the department of pharmaceutical chemistry. He has been associated for some time with the Battelle Memorial Institute of Columbus, Ohio.

University of Wyoming, School of Pharmacy.—Dr. David W. O'Day spoke recently before the Cheyenne Rotary Club on the general theme of the pharmaceutical curriculum and the opportunities for men who are well-trained in the pharmaceutical sciences.—Plans are now being made to form a student pharmaceutical organization. It is planned to have regular meetings at which there will be guest speakers or programs of a professional nature.—Through the efforts of Dr. Charles V. Netz, the library will receive many valuable unbound and bound volumes of pharmacy journals from the private collection of Prof. Gustav Bachman of the University of Minnesota. A number of valuable books have also been donated by Prof. F. E. Hepner of the chemistry department and

Dr. C. O. Lee of Purdue has provided the library with valuable library records.—Dr. J. Thomas Field, Dr. W. M. Garrison and Mr. Benjamin F. Barnes are new faculty members attached to the department of chemistry.

Social Hygiene Day

Dr. Robert P. Fischelis, chairman of the Joint Committee of the American Pharmaceutical Association and the American Social Hygiene Association has requested the pharmaceutical press to give publicity to the fact that February 5, 1947, has been designated as Social Hygiene Day.

In the control of all contagious diseases a most important factor is a sound educational program which will give the public information as to the nature of the disease and the means by which it is spread.

In the struggle against venereal disease the pharmacist occupies a very special strategic position for reasons that are obvious. In this he should take a leading part.

Dr. Fischelis has made some suggestions as to how pharmacists may help in this work. While this issue of the Journal will not reach our readers before Social Hygiene Day has passed we are printing these suggestions in order that they may be useful for us in the days to come. They are as follows:

"1. That Secretaries of State Pharmaceutical Associations obtain from the American Social Hygiene Association, the sponsor of National Social Hygiene Day observance, 1790 Broadway, New York 19, copies of the Social Hygiene Announcement folder, STAMP OUT VD, and enclose it with a letter to their local associations or key men, outlining the purposes of Social Hygiene Day and asking their cooperation in stimulating effective community programs.

"2. That Secretaries of local Pharmaceutical Associations be asked to get in touch with their community social hygiene societies, councils of social agencies, health officers and other community leaders, and offer assistance in carrying out community programs.

"3. That word about Social Hygiene Day and the fight against the venereal diseases be carried in pharmaceutical bulletins and journals.

"4. That arrangements be made with state or local health departments for the procurement and use of the leaflet, HERE'S WHAT YOU SHOULD KNOW.

"5. That educational materials about the social hygiene program be supplied to colleges of pharmacy for distribution to students. Health Departments and the American Social Hygiene Association are good sources of such materials."

Miscellaneous Items of Interest

A Memorial

Henry C. Christensen

On the twentieth day of January 1947, Dr. H. C. Christensen embarked upon new fields of endeavor beyond the horizon that limits the activities of men. Born in Wisconsin, he grew to young manhood on a Nebraska farm where he was subjected to all the hardships and toil of pioneer life in the country of the great plains. The product was a vigorous body and a courageous spirit. With that preparation he went to Chicago in the early nineties and was gradauted with honor from Northwestern University College of Pharmacy in 1893. He operated his own retail store in Chicago from 1893 to 1911. He served as a member of the Illinois Board of Pharmacy from 1907 to 1921. He was elected secretary of the National Association of Boards of Pharmacy in 1914, a position in which he served with distinction until 1942 when he retired because of ill health. During these years of active life he served his state, his country and his profession in positions of honor and trust. His civic interests were as broad as his scientific and professional ones.

To him more than to any other man of his time we owe our present uniform minimum educational and experience requirements for the practice of pharmacy. Many things could and will be said in the pharmaceutical press about his services and accomplishments and to say them here would be only to repeat them once more. The Editor's tribute will be a more personal one.

Dr. Christensen was one of the kindest, the gentlest, the mellowest of men. In his convictions he was firm and unshakable. He always reminded me of an elder in my church when I was a young man. Fred Mason was his name. Mr. Mason was to move to another town. The church gave a parting affair in his honor. It fell upon me to give a parting word to him. All I could say was, "If I knew Fred Mason would be at my funeral I would feel more comfortable." What more could a man say of another. Through all of the pharmaceutically turbulent years when standards of pharmaceutical education and practice were at stake, when I saw Dr. Christensen was present I had the feeling, that all was well. H. C. Christensen was a solid rock in a turbulent sea that no wave force could shatter. What more can a man say of another than that. His children and his grandchildren and his great grandchildren can view with pride his accomplishments as one of the great educators of his day whose imprint upon pharmaceutical education and the practice of pharmacy will remain long after names have passed from memory.

Rufus A. Lyman.

Pharmaceutical Survey Current

November 1946

Members of the Committee on the Pharmaceutical Survey

Operations November: The month was a short one with its five Saturdays and two holidays. Yet it was filled with busyness having to do with things that have become old and things that are new. We have come near the end of the first stage of The Survey—that of planning and reconnaissance. Now we are in the midst of analyzing and assessing the data assembled during recent months. This involved not a little drudgery, made more so by the lack of sufficient assistance. However, there are indications that we shall soon have some trial balances of the accounts between forensics of pharmacy and the facts of pharmacy.

The rising tide of correspondence, clearly indicative of strong currents of interest in the activities of The Survey, while extremely gratifying, does require new plus effort by the limited staff.

Project Progress: The accumulated masses of data relative to enrollment and degrees, accredited schools and colleges 1931-46; salaries, experience, and service of members of teaching staffs; textbooks in use; fees, scholarship, and fellowships; and the pharmaceutical syllabus are being sorted and evaluated.

Prescription Study: The Prescription Study is in full swing in 37 states and the District of Columbia, with appoximately 335 pharmacies participating. Participants are expected from four additional states. Arrangements have been completed for a special contribution of one day's prescriptions from each of fifty branches of a chain organization, comprising all its branches in one city. Completed "Presciption Study Cards" have already been received from 54 pharmacies, with individual contributions running from 25 cards per pharmacy to as high as 331 cards. The analysis of returns at Ohio State University will be under way shortly.

Predictive and Achievement Testing: The statistical work of the Predictive Testing program is fairly well along and the preliminary report by Dr. Remmers is in preparation. The four subcommittees on the Achievement Testing program (Pharmacy, Pharmacognosy, Pharmacology, and Pharmaceutical Chemistry) have reported substantial progress with the statements of instructional objectives.

Subcommittee for Retail Druggists: A special subcommittee of retail druggists has been appointed in cooperation with the National Association of Retail Druggists to serve as a Subcommittee of The Pharmaceutical Survey to consider problems pertaining particularly to the retail drug field. The initial meeting will be held in Chicago on December 12.

Alumni Professional Study: Four representative schools of pharmacy have undertaken a detailed study of the professional life history of their alumni. This promises to furnish a set of revealing facts as to the human factor of pharmacy in action. Other schools have volunteered to participate in this study.

Professional Curriculum: The design for the study of the curriculum now in operation in the various schools and colleges has been completed. During the coming month, special attention will be given to this all-important feature of training for pharmacy. Here The Survey is co-operating with the Association of College of Pharmacy, through the recently created Curriculum Committee.

Inventories: The first step of the collection of retail inventories have been received. The initial steps for the study of their significance, especially for training, have been taken.

Contacts: From the daily journal of the Director, the following items with reference to contacts in the field are selected:

Nov. 6, 1946—Conference with Secretary A. K. Barta of The Proprietary Association.

Nov. 8, 1946—National Drug Trade Conference (Washington).

Nov. 14, 1946— Visitation of School of Pharmacy, Medical College of the State of South Carolina, Charleston, S. C.

Address, The Southeastern Pharmaceutical Conference, Charleston, S. C.

Nov. 15, 1946—Visitation, School of Pharmacy, University of South Carolina, Columbia, S. C.

Nov. 16-18, 1946—Visitation, School of Pharmacy, University of North Carolina; Conference, Secretary, State Board of Pharmacy, and Secretary of State Association, Chapel Hill, South Carolina.

Nov. 19, 1946—Conference Dr. Curt P. Wimmer, Executive Editor, New York State Pharmacist, New York City.

Nov. 20, 1946—Meeting, Directors of National Association of Chain Drug Stores, New York City.

Visitation, Columbia University College of Pharmacy.

EDWARD C. ELLIOTT, Director.

Pharmaceutical Survey Current

December, 1946

Operations December: Processing of foundation data from returned questionnaires continues, although greatly handicapped by lack of working space and staff. Insistent efforts have been required during this

month to speed delayed returns on the nine questionnaires distributed since May to the schools and colleges of pharmacy.

Correspondence continues in heavy volume. It is gratifying to note that many unsolicited letters are coming in from various parts of the country, indicating interest in the survey, enclosing timely reports and references, and extending invitations to visit pharmaceutical laboratories, pharmaceutical associations, etc.

Items

Attendance and Graduation Data: Depending upon the success in prying loose from certain of the institutions the figures required to fill the gaps in our consolidated country-wide tables, it is hoped to be able to distribute by the end of January the preliminary findings as to the supply and need of trained pharmaceutical personnel.

Prescription Study: Of the 349 individual pharmacy participants located in 38 states, 191 have returned approximately 11,000 completed Prescription Study Cards. This includes an outstanding contribution from each of 50 branches of a chain organization in one city.

Close to 8,000 cards have been transmitted to Ohio State University for processing. A trial run of a small batch is now being made in preparation for a conference to determine final processing procedure.

Repeated evidence is being received of the painstaking care, effort, and cooperation extended by participants in this study. It is no little source of encouragement, and warrants unstinted praise.

Plans are being made for collection of prescriptions from a small, representative group of hospitals.

Predictive And Achievement Testing Program: A total of 54 schools of pharmacy are now participating in the program. Forty-eight of the schools have made returns for the predictive tests given in the autumn. These are now being scored.

Arrangements have been made to hold a Conference of Chairmen of the Achievement Test Subcommittees, at the University of Illinois College of Pharmacy on January 10, 1947. The following problems will be discussed:

1. Overlapping among the tests in the four curricular areas.
2. Curricular variation among institutions.
3. Objectives which are to be neglected in the tests because not amenable to evaluation by paper-pencil tests.
4. Problems in test-item construction.
5. Problems in the measurement of achievement in non-pharma-

ceutical areas in the curricula of pharmacy schools.

6. Consideration of methods of facilitating the construction of tests.

Subcommittee of Retail Pharmacists: On December 12, the following members of the Subcommittee of Retail Pharmacists, set up in cooperation with Mr. John Dargavel of the N.A.R.D., convened in Chicago: Frank Gallaher, Gallaher Drug Company, Dayton, Ohio; Dan Marsh, St. Cloud, Minnesota; Frank W. Moudry, Chairman, Executive Committee of the N.A.R.D., St. Paul, Minnesota; Merle Sanders, Snyder's Drug Store, Minneapolis, Minnesota; Ray Smith, Steelman Drug Company, Joliet, Illinois; and Charles R. Walgreen, Jr., Walgreen Drug Company, Chicago, Illinois. The Agenda for the meeting consisted of a detailed list of specific problems in the retail field. Since a large segment of the pharmacy profession is represented in the retail field, the work of this subcommittee should be of extreme importance to the Survey.

Alumni Professional Survey: A 76% return has already been received from one of the participating colleges of pharmacy conducting a survey of the professional history of its graduates. Another college of pharmacy, conducting a similar survey, anticipates at least a 60 to 70% return. Two additional institutions are now polling their alumni.

Historical: Dr. George Urdang, Director of the American Institute of the History of Pharmacy, has completed his chapter on the historical background and origins of American Pharmacy. This contains significant material for an understanding of the nature of many of the present day problems of the profession.

Accreditation Of Colleges And Schools Of Pharmacy: On December 5, the Director of the Survey held an all-day conference with Dean DuMez, Secretary of the American Council on Pharmaceutical Education, relative to procedures and standards for accrediting institutions. The Director has been invited to attend the January 18 meeting of the Council in Baltimore for further discussion of these matters.

Poll Of Faculty Staffs: Arrangements were made with the dean of one of the colleges of pharmacy to secure from the members of his staff an appropriate statement of the current problems of the profession, together with recommendations regarding methods of solution. It is planned to secure similar statements from the faculties of other institutions.

Professional Curriculum: Arrangements have been made with the Chairman of the Curriculum Committee of the A.A.C.P. to hold a conference of committee members at the University of Illinois College of Pharmacy on January 11, 1947. (The members of the Committee have also been invited to attend the meeting being held on the previous day on the Achievement Testing Program.)

The Pharmaceutical Survey has secured the services of Dr. Lloyd Blauch, of the U. S. Office of Education, to undertake a special study of the Pharmaceutical curriculum. Dr. Blauch's previous experience in curriculum studies, especially those relating to dentistry, will be of great value in this phase of the work of the Survey.

Cooperation With Committees Of The A.A.C.P.: During the month, communication has been had with the chairman of each of the standing committees of the A.A.C.P. relative to the coordination of the work of the Survey with the programs of action of the committees. In every instances, the responses have been such as to pave the way for joint economical efforts.

Contacts: During the month of December, the following conferences, visitations, and consultations appear on the Director's calendar:

Dec. 3, 1946.	Conference with Thomas N. Beavers, President, and G. B. Burrus, Vice President, Peoples Drug Stores, Washington, D. C.
Dec. 5, 1946.	Conference with Dean DuMez, Baltimore.
Dec. 9, 1946.	Visitation, College of Pharmacy, Butler University, Indianapolis, Indiana.
Dec. 9, 1946.	Visit, Eli Lilly Company, Indianapolis, Indiana.
Dec. 10, 1946.	Conference, H. H. Remmers and Dean Jenkins, Purdue University, Lafayette, Indiana.
Dec. 11, 1946.	Visitation, University of Illinois College of Pharmacy. Conference, Dean Serles and Professor George L. Webster, Chairman of Curriculum Committee, A.A.C.P.
Dec. 12, 1946.	Meeting of Subcommittee of Retail Pharmacists, Hotel Sherman, Chicago, Illinois.
Dec. 12, 1946.	Conference, P. H. Costello, Secretary, National Association of Boards of Pharmacy, Chicago, Illinois.
Dec. 13, 1046.	Visit, Abbott Laboratories, Waukegan, Illinois.

Edward C. Elliott, Director.

Pharmaceutical Survey Current

January 1947

Members of the Committee on the Pharmaceutical Survey:

For The Survey, the coming of the hopeful New Year meant merely the continuation of the busy old year. During the first week our work progress schedules were reviewed and revised. It was evident that circumstances had conspired to slow down the planned movement and completion of projects. This was especially so in the cases de-

pending on data and information from the schools and colleges. However, it is constantly kept in mind that the officers and staffs of these institutions are obliged to carry an abnormal load of duties on account of the extraordinary student attendance. Again, many institutions have not been in the habit of maintaining much needed records. By the exercise of patience and mutual consideration the gaps are gradually being closed. Again the absence of adequate working quarters and lack of capable clerical help have braked us to slow speed. In spite of all The Survey moves nearer to its goals.

January Jingling

As this number of the Current is being drafted, one is aware of the almost continuous jingling of the calculating machines. The data relative to the tables containing the country-wide attendance and graduates are moving toward completion. Already it is possible to see that during the past decade and a half, the academic mortality of the pharmaceutical training institutions is altogether too great. The cost of pharmaceutical training is too high to use any of the resources and power for processing raw material not to be qualified for licensing.

Perhaps the most important item in the journal of the month was that Dr. L. E. Blauch, of the staff of the U. S. Office of Education, whose appointment as Assistant Director in Charge of Curricular Studies was announced last month, has begun his work on the pharmaceutical curriculum.

The January Journey

The days from the 8th to the 18th were spent in the middle west. Conferences relative to the testing programs and personnel studies were held with Dr. Remmers and Mr. Gage in Lafayette, Indiana. On the 10th and 11th, important conferences were held in Chicago of the chairmen of the several committee in charge of the preparation of the achievement examinations. The Survey arranged for the members of the Committee on Curriculum of the A.A.C.P. to meet at the same time. It was fortunate that Dr. W. W. Charters, Chairman of the Committee on The Pharmaceutical Survey was able to attend.

Profitable conversations were held with representatives of the A.M.A., A.D.A., and North Central Association with special reference to accrediting procedures. Secretary Costello contributed wise counsel.

Then to Milwaukee where, under the guidance of President-Elect Dretzka of the A. Ph. A., I met with the professionally energetic Milwaukee County Pharmaceutical Association. The leadership of Mr. Vernon Johnson of Racine provided a dramatic demonstration of the continuation study work for pharmacists being developed under the Wisconsin State Board of Education. Incidentally, there was some helpful drug store visiting in Milwaukee.

Before returning to Washington attended the meeting of the American Council on Pharmaceutical Education in Baltimore. Proposals relative to the reinspection and reaccrediting of institutions were presented.

January Jottings

During the final days of the month, Mr. Mordell was in Columbus checking the results of the processing of the first thousand prescriptions collected for the Prescription Study. His records show that thus far approximately 13,000 prescriptions have been collected from 218 pharmacies in 37 states.

The next meeting of the Committee on The Pharmaceutical Survey will be held in Washington on March 6th. Critical decisions relating to the present and future undertakings are suggested by the agenda.

Edward C. Elliott, Director.

Minutes of the Meetings of the Executive Committee of American Association of Colleges of Pharmacy

Chicago, Illinois

December 20, 21, 1946

First Session—December 20, 1946

The Executive Committee met at 9:30 A. M. with Chairman Christensen presiding. Present: Deans Christensen, Daniels, Jenkins, Lyman, Rogers, Uhl, and Secretary Eidsmoe.

Chairman Christensen called attention to the meeting of the American Council on Education January 24-25, 1947. It was suggested the Secretary write to the A.A.C.P. Delegates to this Council informing them that expenses are provided in our budget for attendance and asking that all delegates attend. It was suggested that Association members of the A.Ph.A. Council would be meeting in Washington a few days prior to the dates of the meeting of the American Council on Education and that some of these men might be prepared to act as alternates should it be necessary to insure full representation at the meeting. It was suggested the Association pay additional hotel expenses which would be incurred by such alternates staying over for this meeting.

It was moved by Dean Daniels, seconded by Dean Lyman, we pay hotel expenses of two alternates in addition to the three delegates to attend the American Council on Education meeting January 24-25, 1947. Carried.

Deans Jenkins and Serles were proposed as alternates and both consented to act.

Chairman Christensen reported he had met with Secretary Costello of the N.A.B.P. to work out scheduling plans and topics for programs for the District Meetings of the N.A.B.P. and A.A.C.P. It was agreed the arrangements for scheduling should be left to Secretary Costello since he is required by his Association to attend all District meetings. Two topics were agreed upon for discussion at all District meetings:

(1) The Plan Approved by the N.A.B.P. for Obtaining Practical Experience

(2) The Pharmaceutical Survey Resume by Dr. Edward C. Elliott

In addition to the above it was agreed that "Limitation of Enrollment" should be suggested as a topic for discussion at the District Meetings.

It was moved by Dean Jenkins, seconded by Dean Daniels that the Chairman appoint a committee of three with Dean Rogers as Chairman to draw up a resolution outlining the policy of the A.A.C.P. on limiting enrollment. Carried.

The Chairman appointed Deans Jenkins and Daniels as the additional members of this committee.

Dean Daniels presented an outline of the six-year curriculum which is proposed for the University of California. The first two years of this curriculum consist of the pre-pharmacy and the last four years of pharmacy subjects. He asked for suggestions for a name for the degree to be awarded for the course. It was the recommendation of the Executive Committee that a Master of Science in Pharmacy degree be awarded for the six-year course outlined.

It was moved by Dean Jenkins, seconded by Dean Uhl that it is the sense of the Executive Committee that the doctorate degree in pharmacy be restricted to not less than a seven year program. Carried.

Dean Christensen outlined the proposed five-year program for The Ohio State University College of Pharmacy. Beginning with the Fall Term in 1947 this will consist of one year of pre-pharmacy and three years of pharmacy for which the Bachelor of Science degree will be awarded. Beginning with the Fall Term in 1948 the course will consist of two years of pre-pharmacy followed by three years of pharmacy for which the Bachelor of Science degree will be awarded. Superior students may be granted the Master of Pharmacy degree.

A question was raised as to the status of the funds for the Professorial Lectureship Tours. The Secretary reported that although he understood the Foundation had agreed to provide funds for these tours he had not been officially informed of any such action and that no funds for the tours had been received from the Foundation.

It was moved by Dean Jenkins, seconded by Dean Rogers that the Secretary communicate with the Foundation advising that plans for the Professorial Lectureship Tours are completed and to ask that the funds be paid into the A.A.C.P. Treasury. Carried.

The Secretary was directed to explain that because of the objection raised to the name "American Foundation for Pharmaceutical Education Lectureships" that with the approval of the Foundation they will be designated "American Association of Colleges of Pharmacy Lectureships."

President E. R. Serles of the A.Ph.A. and Secretary P. H. Costello of the N.A.B.P. appeared at the meeting and joined the Executive Committee for lunch. The Executive Committee recessed for lunch at 12:30 P. M.

The meeting was resumed at 2:00 P. M. at which time Dean Wilson joined the Committee.

President Serles informally discussed plans for the A.Ph.A. annual meeting with special reference to the time allotment for the A.A.C.P.

Editor Lyman reported on the increased costs of publication of the Journal. This was followed by a discussion of the desirability of expanding the Journal and publishing it more frequently and of the problems of financing such expansion.

It was moved by Dean Jenkins, seconded by Dean Daniels that the subscription rate for the Journal be increased to $4.00 per year beginning January 1, 1947. Carried.

The Secretary was directed to accept all remittances received up to January 1, 1947 at the old rate of $2.00 but to return those received after that date with the information that the rate was increased to $4.00 per year.

The Secretary was directed to write the Americon Foundation for Pharmaceutical Education that it is the sense of the Executive Committee the Journal should be expanded and published monthly and to ask that the Foundation give consideration to providing a grant of $7500.00 for this purpose, calling attention to the fact the subscription rate has been increased to $4.00 per year.

It was moved by Dean Daniels, seconded by Dean Jenkins that owing to printing cost that publication of the Constitution and By-Laws be delayed for the present time and that only Amendments be published and reprints of these be distributed to the member-colleges. Carried.

Editor Lyman was directed to have 200 reprints of the Amendments prepared.

It was moved by Dean Uhl, seconded by Dean Rogers that all reprints be ordered through the Association and that the price of reprints

be established by the Editor of the Journal to cover costs of printing and handling. Carried.

It was moved by Dean Daniels, seconded by Dean Uhl that the Constitution and By-Laws for the Conference of Teachers of Chemistry which were presented at the Pittsburgh meeting of the Association be referred to the Committee on Teachers' Conferences with the recommendation that the Committee draw up Uniform Constitution and By-Laws for all Conferences, present them to the several Conferences for consideration, and report back to the Executive Committee at the next annual meeting. Carried.

The Secretary was directed to inform the Chairman of the Conference of Teachers of Chemistry of the action taken.

Chairman Christensen read a letter from President Johnson reporting that the University of Santo Tomas in the Philippines had requested membership in the Association.

It was moved by Dean Jenkins, seconded by Dean Wilson that the Chairman appoint a sub-committee of three of the Executive Committee to study the question of affiliation with our Association for foreign colleges. Carried.

Chairman Christensen called attention to the questionnaire sent out annually to the member-colleges. It was pointed out that some of the information is no longer of value to the Association and it was suggested that some of it be eliminated.

It was moved by Dean Rogers, seconded by Dean Uhl that the Chairman of the Committee on Constitution and By-Laws be asked to study Article I, Section 6, Paragraph "e" of the By-Laws and make revision to limit the amount of information required from the colleges. Carried.

It was moved by Dean Jenkins, seconded by Dean Daniels that for the Annual Report for the school year 1946-47 the items in columns 2, 5, 11, 13 and 14 of the present questionnaire form be deleted. Carried.

The Executive Committee recessed for dinner at 6:30 P. M. and resumed its discussions at 8:00 P. M.

It was moved by Dean Daniels, seconded by Dean Rogers that the Chairman of the Executive Committee discuss the matter of the time of the Annual Meeting with President Serles and Secretary Fischelis of the A.Ph.A. with the purpose of securing time for the A.A.C.P. from Sunday through Tuesday Evening. Carried.

It was moved by Dean Jenkins, seconded by Dean Uhl that so far as it is possible that a half day of the Annual Meeting be set aside for discussion of pharmaceutical education problems. Carried.

It was moved by Dean Daniels, seconded by Dean Uhl that it is the sense of the Executive Committee that the American Foundation for Pharmaceutical Education be urged to continue on the present basis to allocate scholarships to colleges. Carried.

The Secretary was directed to:

1. Transmit to the American Foundation for Pharmaceutical Education a copy of the Resolution of Thanks adopted at the 1946 Annual Meeting.
2. Transmit to the American Foundation for Pharmaceutical Education a copy of the resolution adopted at the 1946 Annual Meeting urging financial support for the American Journal of Pharmaceutical Education.
3. Transmit to Dr. E. C. Elliott a copy of the resolution from the President's Address adopted at the Annual Meeting endorsing the objectives of The Pharmaceutical Survey.
4. Transmit to Dr. E. C. Elliott a copy of the resolution from the Committee on Educational and Membership Standards adopted at the 1946 Annual Meeting commending the action of The Survey Committee in its inauguration of entrance tests for students in pharmacy.
5. Transmit to Chairman H. W. Burlage of the Pharmaceutical Syllabus Committee the resolution of thanks adopted by the Association.
6. Write to Chairman Burlage calling attention to the resolution adopted in regard to the dissolution of the Syllabus Committee and request information as to the materials and funds on hand and whether or not these will be disposed of in conformity with the resolution.
7. Write Secretaries Costello and Fischelis calling attention to the resolution pertaining to the Syllabus Committee and inviting suggestions for a joint plan of handling this matter.

It was moved by Dean Daniels, seconded by Dean Jenkins that the Chairman of the Executive Committee be authorized to appoint a representative to the National Council on Professional Relations if this Association is invited to name a representative to that Council. Carried.

Upon motion by Dean Jenkins, seconded by Dean Wilson the following resolution was adopted:

WHEREAS, A critical shortage of competent teachers and well trained scientists exists in pharmacy,

THEREFORE BE IT RESOLVED, That the Executive Committee of the American Association of Colleges of Pharmacy urges each member-college to encourage superior students to consider the possibility of pursuing graduate work, and

BE IT FURTHER RESOLVED, That each member-college call to the attention of superior advanced students the opportunities provided through graduate assistantships and fellowships for the pursuit of graduate studies.

It was directed that the foregoing resolution be mailed to all member-colleges.

Adjourned 10:40 P. M.

Clark T. Eidsmoe
Secretary

Second Session—December 21, 1946

The Executive Committee Meeting was called to order at 9:10 A. M. by the Chairman. Present: Deans Christensen, Daniels, Jenkins, Lyman, Rogers, Uhl, Wilson and Secretary Eidsmoe.

Chairman Christensen read a letter from President Johnson in which the latter expressed himself as favoring representation of the American Association of Colleges of Pharmacy by delegates to the United States Pharmacapoeial Convention. President Johnson reported he had already written Dr. Swain requesting that consideration be given to such representation for our Association.

During the discussion which followed it was suggested that one reason the Association does not have accredited delegates to the U.S.P. Convention is that ours is not an incorporated Association.

It was moved by Dean Uhl, seconded by Dean Jenkins that the officers take steps toward incorporating the American Association of Colleges of Pharmacy. Carried.

Chairman Christensen read a letter from Dean Rowe asking if the Association could take any action to attempt to change the attitude of Medical Colleges in regard to the granting of credit for liberal arts courses taken in a pharmacy college toward pre-medical requirements.

It was moved by Dean Daniels, seconded by Dean Uhl that it is the sense of the Executive Committee that the solution to the problem rests in the individual school and it is not appropriate for the Executive Committee to take any action on the request as presented. Carried.

A clarification of the various "World Congresses" was asked for. Chairman Christensen asked Dean Jenkins to explain the situation. Dean Jenkins stated we have committees working on two projects.

One of these is the Pan American Conference on Pharmaceutical Education, a meeting sponsored by the American Association of Colleges of Pharmacy which is to include educators in pharmacy in all of the countries of the Western hemisphere. It is planned to hold this meeting in 1948. The other project is the World Congress for Pharmaceutical Education which, as the name indicates, is to include educators in pharmacy from all countries of the world. It was the original plan that this meeting would be held in 1950 but because the A.Ph.A. is contemplating such a meeting in 1952 it is thought advisable for the two Associations to work together in planning this meeting.

The Chairman of the Executive Committee was directed to write Secretary Fischelis with the idea of enlisting the cooperation of the A.Ph.A. in making arrangements for the World Congress for Pharmaceutical Education.

The Chairman of the Executive Committee was directed to write to President Johnson suggesting that the latter get in touch with Chairman R. B. Smith of the Committee on Pan-American Conference on Pharmaceutical Education to ascertain what progress his committee is making.

Dean Daniels drew attention to the grants-in-aid for research from the U. S. Public Health Service, pointing out that while many of the areas embraced in the study were those which definitely belong to pharmacy, no study section in a pharmaceutical field had been established. He suggested that the U. S. Public Health Service be approached in this matter with the idea that a study section in pharmaceutical chemistry be established.

Dean Daniels offered to write Dr. Fischelis asking that he take this matter up informally with the proper authorities in the U. S. Public Health Service to ascertain what, if anything, can be done to include pharmacy in the research program. Chairman Christensen also agreed to take the matter up with Dr. Fischelis.

The Committee consisting of Dean Rogers, Chairman, and Deans Jenkins and Daniels appointed to draw up a resolution in regard to Limitation of Enrollment presented the following:

> WHEREAS, It has come to the attention of the Executive Committee of the American Association of Colleges of Pharmacy that a number of colleges of pharmacy have admitted students in excess of the number that their physical facilities can adequately accommodate and to whom quality instruction can ge given by their present staff and,
>
> WHEREAS, The American Council on Pharmaceutical Education and the National Association of Boards of Pharmacy have called attention to the dangers inherent in such situations and

because the Executive Committee of the American Association of Colleges of Pharmacy is desirous of reiterating its opposition to such over crowding of colleges of pharmacy,

IT IS RESOLVED, That the American Council on Pharmaceutical Education and the National Association of Boards of Pharmacy be urged to take such steps as may be in their province to restrict enrollments and if necessary withdraw accreditation and recognition of those colleges which fail to maintain enrollments within the limits indicated by sound educational practice.

Upon motion by Dean Uhl, seconded by Dean Daniels, the foregoing resolution was adopted with the direction that copies of it be sent to the Secretaries of the American Council on Pharmaceutical Education, the National Association of Boards of Pharmacy, the American Pharmaceutical Association and to each of the colleges of pharmacy.

Chairman Christensen reported that Secretary Fischelis had asked for suggestions as to means by which the American Pharmaceutical Association can be of assistance to the American Association of Colleges of Pharmacy. The following were suggested as areas in which the American Pharmaceutical Association might render a service to our Association:

1. Use its influence to secure recognition for pharmacy in the U. S. Public Health Service, the Civil Service, and the National Research Council.

2. Use its influence to have pharmacy included in the Professional Roster.

3. The American Pharmaceutical Association might act as a promotional agency to work for the advancement of pharmacy by securing recognition for it in the American Academy of Science and in the American Association for the Advancement of Science. The nomination of pharmacists to these bodies would be a recognition of pharmacy.

4. The American Pharmaceutical Association should urge its representatives on the American Council on Pharmaceutical Education to take a stand for higher standards in accreditation and education.

5. The American Association of Colleges of Pharmacy has already expressed need for a full-time Secretary. If the American Pharmaceutical Association can aid in the furtherance of this program or assist in securing funds for this purpose it would be an aid to pharmaceutical education.

6. The American Pharmaceutical Association could aid pharmaceutical education by continuing the support of research by

grants from the American Pharmaceutical Association Research Fund.

7. The American Pharmaceutical Association should encourage employment of pharmacists in industry, in Association and other laboratories where pharmaceutical products are involved.
8. The American Pharmaceutical Association might take action to discourage the establishment of new schools of pharmacy and continue to curb sub-standard schools now in existence.
9. Encourage improvement of physical appearance in drug stores.
10. Discourage harmful advertising on radio and in the press.
11. Develop higher standards in hospitals.

Chairman Christensen volunteered to present the foregoing suggestions to Secretary Fischelis.

Upon motion by Dean Jenkins, seconded by Dean Wilson the following resolution was adopted:

WHEREAS, The American Pharmaceutical Association has aided in securing recognition for pharmacy and pharmacists in the U. S. Public Health Service, the Veterans' Administration, the U. S. Civil Service, and in many other ways has directly or indirectly aided the cause of pharmaceutical education,

THEREFORE BE IT RESOLVED, That the Executive Committee of the American Association of Colleges of Pharmacy thank the American Pharmaceutical Association and its Secretary, Robert P. Fischelis, for the services which they have rendered to the cause of maintaining and advancing pharmaceutical education.

The Executive Committee recessed for lunch at 12:45 P. M. and resumed its discussions at 2:00 P. M.

Chairman Christensen reported that the American Council on Pharmaceutical Education would like to have the suggestions of the American Association of Colleges of Pharmacy regarding minimum admission requirements and minimum curricular requirements, and would also appreciate suggestions concerning facilities and standards for determining whether a college is in a position to offer graduate instruction. Chairman Christensen expressed the opinion the Association should recommend such standards. The problem was discused by the Executive Committee at some length.

It was moved by Dean Daniels, seconded by Dean Wilson that the matter of minimum standards be submitted to the Committee on Edu-

cational and Membership Standards for study and report at the Annual Meeting. Carried.

It was moved by Dean Jenkins, seconded by Dean Daniels that the request of the American Council on Pharmaceutical Education to the American Association of Colleges of Pharmacy for suggestions and recommendations concerning facilities and standards as a basis for offering graduate instruction be formulated by the American Council on Pharmaceutical Education in a clearly written statement and referred back to the Executive Committee of the American Association of Colleges of Pharmacy so it may be referred to the proper committee for study. Carried.

The Secretary was directed to send a copy of the foregoing motion to Secretary DuMez.

It was moved by Dean Rogers, seconded by Dean Uhl that when such statement is received from the American Council on Pharmaceutical Education it be referred by the Secretary of the American Association of Colleges of Pharmacy to the Committee on Graduate Study with the request they report on the matter at the next Annual Meeting. Carried.

It was moved by Dean Lyman, seconded by Dean Rogers that the note in the Report of the 1946 Meeting in regard to the election of Union University Albany College of Pharmacy be corrected to read:

"The election of Union University Albany College of Pharmacy by mail ballot was confirmed by roll-call vote."
Carried.

It was moved by Dean Rogers, seconded by Dean Daniels that expenses of members of the Executive Committee to the Chicago Meeting be paid by the Association. Carried.

It was moved by Dean Jenkins, seconded by Dean Uhl that the Secretary write Secretary Newcomb that if it meets with the approval of the Foundation the name American Association of Colleges of Pharmacy Lectureships will be adopted for the Professorial Lectureships. Carried.

It was moved by Dean Jenkins, seconded by Dean Daniels that the rules for the Professorial Lectureship Tours be approved. Carried.

It was moved by Dean Daniels, seconded by Dean Rogers that the Minutes of the Meetings of the Executive Committee held at Pittsburgh in August be approved. Carried.

It was directed that the Minutes of this Meeting be sent to all members of the Executive Committee and that the Secretary ask each member to express approval or corrections.

The Secretary was directed to send a letter to President Johnson and Dean Ballard expressing the regrets of the Association that because of illness they were unable to attend the meeting.

A rising vote of thanks was extended to the Secretary.

Adjourned at 4:10 P. M.

Clark T. Eidsmoe,
Secretary.

Committee on Status of Pharmacists in Government Service

Report of the Steering Committee

Pursuant to previous instructions from the whole committee, the Steering Committee made arrangements thru Congressman Durham to meet with General Norman T. Kirk, Surgeon General of the Army on November 13th, 1946. At General Kirk's invitation the committee met with his group at the Army and Navy Club, in Washington. Present were General Kirk, Colonel Francis Kintz, personnel officer of the Surgeon General, Lt. Colonel W. Piper, his assistant, Major Bernard Aabel, Pharmacy assistant to the Surgeon General, Colonel J. H. Michaelis, General Staff, Dr. Robert P. Fischelis, Dr. A. G. DuMez, Mr. George H. Frates, Congressman Carl Durham, Arthur H. Einbeck.

The chairman explained the various problems disturbing to pharmacy and further explained that the steering committee had no power to make agreements, that we were instructed to work for the retention of the Pharmacy Corps, and if these discussions resulted in the clarification of some points, the problem would still have to be referred to higher authority. The points stressed were that there should be some substantial evidence that the Surgeon General's plan for a Medical Service Corps would adequately take care of the pharmaceutical service of the Army. That educational qualifications should be included as a requirement for admission to the Corps in order that it would not be a substandard one. That the opportunities for promotion in the Corps should be equivalent to that enjoyed under the present Pharmacy Corps law. That the appointment of Dr. Kidder as a consultant to the Surgeon General on Pharmacy be augmented by the appointment of a committee of consultants so that manufacturing, research, distribution, education and professional pharmacy be represented to insure that military pharmacy will always be at the peak of development. That since the standard of pharmaceutical service would depend upon the quality of pharmacist that we could interest to apply for service,

the opportunities in the service should be of such a high level as to attract the finest men to the Service.

General Kirk stated that he agreed essentially 100% with the objectives of the Committee, **however, there were several points advanced by the Chairman which he stated his representatives would discuss more in detail.** He reiterated that in order that his Department might effectively function he could not do the job with a lot of small Corps. He said that he hoped that we would not kill the Medical Service Corps but rather give it an opportunity to show what it could do for pharmacy and the other services. The flag of pharmacy would wave just as freely and importantly in such a Corps. He invited us to remain and go into further details with his Staff and the representative of the General Staff present, and apologized that he had to leave early to attend a conference with General Eisenhower. The officers present took up the points one by one and discussed them. Colonel Michaelis stated that the Medical Service Corps Bill was being rewritten by the General Staff and provisions are being made for the creation of a **Pharmacy Section**, **Optometry Section**, and a **Sanitary Section** in the bill; there will be a head of the Pharmacy Section designated **who will be a pharmacist who will be the consultant to the Surgeon General on problems peculiar to the specific section.** Upon questioning he stated and was supported by Colonel Kintz, that in professional problems he would have direct access to the Surgeon General. It was stated that in addition to the professional duties of pharmacy, **other many and varied** administrative duties in the Corps would be the responsibilities of **members of the** Pharmacy Section. Upon being questioned as to who would head the Service Corps, Colonel Kintz stated that it was reasonable to assume that ultimately it would be a pharmacist, since the pharmacy group would be the largest represented in the Corps.

Colonel Michaelis stated that the promotion set up would be as great as possible considering the needs of the service. He covered the present general army situation and said that the contemplated set up would allow for **approximately 60%** junior officers and **approximately** 40% field officers of the rank of major or over. This compares favorably with the overall army set up which is between 37 and 38% field officers. The contemplated Table of Organization estimates that 2% of the Corps would be Colonels. The needs of the service will govern these percentages, by requested changes in legislation from time to time. He stated that the contemplated strength of the Corps would be 1600 officers, they would like 500 of these to be pharmacists, and that General Eisenhower has given permission to hold approximately 500 vacancies for **Medical Service** Corps for graduates of colleges. "You tell us the Colleges you want us to pick from and we'll take them from these schools," said Colonel Michaelis.

Colonel Kintz stressed that the development of pharmacy in the Army would depend largely upon the initiative and the qualifications

of the officer heading the Pharmacy Section. He admitted to the unfortunate pharmaceutical conditions in the Army during the war particularly as pertaining to the status of the pharmacist. These things he said would all be corrected in this contemplated Medical Service Corps set up with its Pharmacy Section. He said that he thought the committee of consultants a good one and that they would have the tendency to keep the head of the pharmacy section "on the ball".

Upon being questioned Major Aabel stated that the "Blue Print" on the Pharmacy Corps submitted some months ago to the Surgeon General was being applied at the present time. He cited the assignment of Pharmacy Officers to take charge of the pharmacies of the larger medical installations. It was also pointed out here that the "Blue Print" would form the basis of a pharmacy plan for the induction of pharmacists into the service in time of war. Similar to the plan of the induction of physicians and dentists during the war just passed.

Colonel Kintz stressed that the Pharmacy Officer heading the Pharmacy Section would make the rounds all over the Army and would naturally make the recommendations that would place the profession in the service on a high plane.

The committee took the opportunity to present some evidence of bad pharmaceutical service that existed during the war just concluded.

The Steering Committee and Mr. Durham reviewed the conference that was just completed and arrived at the following conclusions.

That the relationship between the profession of Pharmacy and the Army manifested by todays frank discussions showed much improvement.

That there seemed to be a sincere desire on the part of Surgeon General Kirk, his Staff and the General Staff as represented at the conference to work out a satisfactory solution to the problem.

That the medical Service Corps with its contemplated standard of educational requirement would place pharmacists on an equal basis with professions holding satisfactory degrees. The contemplated set up would raise the prestige of pharmacy in the Army placing it on a par with Bacteriologists and Sanitary Engineers.

That the **Medical Service Corps with its Pharmacy Section** would provide a satisfactory pharmaceutical service in the Army.

That the **Medical Service Corps with its Pharmacy Section** would provide adequate direction, should a Pharmacist be the head of the **Pharmacy** Section and have direct access to the Surgeon General as an adviser on professional matters.

That the **Medical Service Corps with its Pharmacy Section** will provide opportunities for the placement of more pharmacists than

under the present Pharmacy Corps law, even with possible suitable amendments, and will provide for a greater variety of assignments.

That **the Medical Service Corps with its Pharmacy Section** will give **the profession of Pharmacy in the Army** sufficient authority to **advise the Surgeon General on and** direct the pharmaceutical service of the Army.

That insisting on a separate Corps might be doing pharmacy a disservice by limiting its duties, causing friction and non cooperation by the Surgeon General, his Staff and the General Staff.

There is grave doubt that an amended pharmacy corps law that would be satisfactory to us could be ultimately passed and signed.

That study of the over all plan of the Surgeon General's Medical Service Corps will sound practical to many Army people in Congress, since its operation has been generally proved in combat and has the approval of the General Staff.

That Congressman Durham after having elicited the assent that a copy of the final draft of the Medical Service Corps bill would be submitted to the committee for study prior to being introduced, has stated that in his opinion the committee would do well to go along with the Surgeon General providing the bill that is finally presented will provide the machinery that will help the Surgeon General, his Staff and the General Staff do the things that were promised to us today.

In the light of the improved situation the Steering Committee felt that the Joint Council of the American Pharmaceutical Association and the National Association of Retail Druggists should give further consideration to the work of this committee and express its opinion as to future procedure.

Arthur H. Einbeck, Chairman.

Steering Committee
Mr. George H. Frates
Dr. A. G. DuMez

Federal Security Agency
Regular Corps Appointments for Pharmacist Officers in the U. S. Public Health Service

A competitive examination for appointment in the Regular Corps in grades of Junior Assistant Pharmacist (2nd Lieutenant) Assistant Pharmacist (1st Lieutenant) and Senior Assistant Pharmacist (Captain) will be held during the period March 17-April 16, 1947.

Regular Corps appointments are permanent in nature and provide opportunities to qualified pharmacists for a life career in a number of fields, including hospital pharmacy, pharmaceutical research, public health programs, medical supply, and quarantine inspection. Assignments are made with all possible consideration of the officer's demonstrated abilities and experience. There is ample opportunity for professional growth and development.

An applicant for the grade of Junior Assistant Pharmacist must be a citizen of the United States, must satisfactorily pass a physical examination performed by medical officers of the U. S. Public Health. Applications for this grade will also be considered from senior students and those who successfully pass the examination will be considered for appointment after their graduation.

Applicants for the grade of Assistant Pharmacist must meet the above-mentioned requirements and must have had an additional three years of post-graduate professional training or experience.

Applicants for the grade of Senior Assistant Pharmacist must meet the requirements for the grade of Assistant Pharmacist and must have had an additional four years of post-graduate professional training or experience.

Entrance pay for Junior Assistant Pharmacist with dependents is $3,391 a year, for Assistant Pharmacist with dependents is $3,811 a year, and for Senior Assistant Pharmacist with dependents is $4,351 a year. Promotions are at regular intervals up to and including the grade of Pharmacist Director which corresponds to full Colonel at $8,551 a year. Retirement pay at age 64 is $4,950 a year. Full medical care, including disability retirement at three-fourths pays is provided. All expenses of official travel are paid by the Government. Thirty-days' annual leave with pay is provided. All commissioned officers have full military status for the duration of the present war.

Examinations will be oral and written. The oral and written examinations will be given during the period March 17 through April 16, 1947, at places mutually convenient to the applicant and the Service.

Application forms and additional information may be obtained by writing to the Surgeon General, U. S. Public Health Service, Washington 25, D. C.

Those desiring to make application either for the Junior Assistant, or Senior Assistant grades must mail the completed applications so as to be received not later than March 15, 1947, by the Surgeon General, U. S. Public Health Service.

The North Carolina Pharmaceutical Research Foundation

The pharmaceutical industry of the South took a big step forward on December 19, 1946 when 12 leaders in pharmacy established at the University of North Carolina an organization to be known as the North Carolina Pharmaceutical Research Foundation, Inc.

General purposes of the Foundation are to foster and promote the growth, progress, and general welfare of pharmaceutical education and research at the School of Pharmacy at the University of North Carolina and throughout the State.

Roger A. McDuffie of McDuffie-Eubanks Drug Company, Greensboro, was elected first president. He is a member of the North Carolina Board of Pharmacy.

Elected as vice-president was P. A. Hayes, president of the Justice Drug Company, wholesale drug firm of Greensboro. Dr. E. A. Brecht, professor of pharmacy in the University of North Carolina, was named secretary-treasurer.

Terms of Charter

The Foundation, under the terms of its charter, is a non-profit, charitable corporation, carrying no capital stock and will have the full power to receive donations and bequests; can purchase, lease and otherwise acquire property and can pay in full or supplement salaries of persons engaged in pharmaceutical research and education. It can also donate equipment, materials or other facilities for the development, expansion and extension of educational, research and service projects, thereby promoting the pharmaceutical service of the State and the South through the University at Chapel Hill.

Management of the Foundation and its properties will be vested in the board of directors and all officers and directors will serve without financial compensation. To facilitate its operation an executive committee was elected to be composed of C. T. Council, B. C. Remedy Company, Durham; Paul B. Bissette, Bissette's Drug Store, Wilson; and I. T. Reamer, Duke Hospital, Durham.

Immediate supervision of research projects will be managed by a board of grants consisting of the faculty of the School of Pharmacy actively engaged in graduate instruction: M. L. Jacobs, acting dean; E. A. Brecht, H. M. Burlage, and H. O. Thompson.

Plan Graduate Work

Only 12 of the 66 schools of pharmacy in the United States offer graduate instruction leading to the doctorate degree. The University

of North Carolina is uniquely situated in the center of an area reaching from Maryland to Florida and west to the Mississippi River—an area where the need for this training is great.

At the initial meeting sufficient money was raised to guarantee the requisite minimum funds to inaugurate the program. This will apply directly to the establishment of gradaute fellowships. Other projects include research in cultivation of drug plants and aid in obtaining a new and better building for the School of Pharmacy.

In addition to the officers and the executive commttee the other members of the board of directors are: E. C. Daniel, Zebulon; Congressman Carl T. Durham, Chapel Hill; A. N. Martin, Roanoke Rapids; W. A. Gilliam, Winston-Salem; H. S. McAllister, Chapel Hill; B. F. Page, Raleigh, and W. J. Smith, Chapel Hill.

New Books

Banting's Miracle, The Story of the Discovery of Insulin by Seale Harris, M. D., 1946, 33 illustrations. 250 pp. J. B. Lippincott Company. Price $3.00.

This biography of Banting is one that should be widely read. It is a biography that fulfills every requirement to insure its success among scientific men as well as the laity for it is a book from which inspiration may be derived for everyone. In the first place it is a book concerning a man to whom the human race is eternally indebted not only for his discovery of insulin, but also for his many personal qualities. Second, the book is timely being written now when the Banting Era of diabetes may be maturely evaluated and also not too late that the memory of Banting is fresh in the minds of those who knew him best. And most important, the book is written not as a mere biography but as a memorial to the man stemming from a feeling of "sheer gratitude to Banting." Seale Harris in a simple, delightful manner has recorded not the life of a soldier, scientist, artist, and scholar, but the life of a man.

E. D. L.

The National Formulary, The American Pharmaceutical Association. Eighth Edition. 850 pages 1946. Mack Printing Company. Price $7.50.

The latest edition of this official standard reveals many innovations and features which illustrate the completeness and thoroughness of revision by the Committee on the National Formulary. Becoming official on April 1, 1947, the text will be on a continuous basis through interim revisions or supplements.

Among the new features is the arrangement of monographs. The primary title of each monograph is in English and is followed by a Latinized version of the English title in a secondary position. A marginal index is included with each monograph which represents the actual alphabetic sequence of monographs.

The preface now includes historical material, the principles of revision and other matter formerly included in the latter pages of the text. The pages devoted to General Tests, Processes and Apparatus is considerably enlarged and includes many processes which formerly preceeded the monographs of the several classes of preparations. Of the 188 new admissions many are noteworthy. Among the new chemicals introduced are: Acetarsone, Calcium Levulinate, Colloidal Silver Iodide and Stibophen. New Preparations adopted include: Aminoacetic Acid Elixir, Ferrous Sulfate Syrup, Gentian Violet Jelly, Pentobarbital Elixir, Sippy Powders and Sun Cream. Among the new crude drugs or products of plants introduced are: Ceylon Cinnamon, Coconut Oil, Prepared Ergot, Nutgall, Sodium Alginate and Sterculia Gum.

The Eighth Edition of The National Formulary reflects the change in medical practice since the appearance of the Seventh Edition. The new monographs and the other changes included in the revision will serve the needs of the practitioner of medicine, the practicing pharmacist, the teacher and the student. The Chairman of the Committee on the National Formulary and the members themselves are to be congratulated upon the completion of this valuable contribution.

A. E. S.

Inorganic Chemistry by W. Norton Jones, Jr., Professor of Chemistry, Colorado State College of Agriculture and Mechanic Arts. The Blakiston Company. 783 p. $4.25.

This well written, scholarly text on general chemistry offers an interesting departure from the conventional method of presenting the beginning work in chemistry. The method is perfect in its applicability, and while that proposed is good and rational, it sacrifices much of the simplicity and orientation characteristic of the conventional approach.

Atomic structure is given adequate consideration in an early chapter because, in the experience of the author, the retention and the deduction of facts is implemented by constant reference to modern concepts of electronic structure and to periodic relationship of the elements. In line with this reasoning, the third period elements (sodium, chlorine, aluminum, silicon etc.) are covered in successive chapters because they are most demonstrative of the variations in properties resulting from slight changes in the electronic configuration of the elements. The rationality of this view is accepted, however pattern proposed tends toward heterogenity. For example, sodium and its com-

pounds are covered in Chapter 7, while the alkali metals are treated in Chapter 29, nevertheless gaps of this variety are unavoidable if one wishes to abide by the modern interpretation of the periodic classification of the elements.

For the most part, the subject is well covered, in the most modern light, however, a few chapters are not up to the prevailing high standard. Especially deficient are Chapters 2 and 3, concerned with the Varieties and Subdivision of Matter and Measurements and Calculation respectively.

Mechanically, the book is splendid. The various sections of the individual chapters are numbered and conspicuously labeled for ready reference. The book is profusely and well illustrated, and it is in excellent binding. Problems and questions for each chapter are appended. P. J. J.

Laboratory Manual of Organic Medicinal Products by Walter H. Hartung, Ph. D., School of Pharmacy, University of Maryland, W. T. Sumerford, Ph. D., School of Pharmacy, University of Georgia and Melvin F. W. Dunker, Ph. D., School of Pharmacy, Wayne University. 102 pp. The University of Georgia Press, Athens, Ga., 1946.

As indicated in the preface by the authors, there are relatively few published laboratory outlines dealing with the chemistry of organic medicinal products and the related compounds. They have prepared this manual for the use of students who are familiar with the fundamentals of inorganic and organic chemistry. The experiments contained in Chapters I to XII inclusive have been selected as outlined laboratory tests which will serve to stimulate and increase the student's capacity for chemistry, permit the correlation of properties of organic medicinal compounds with chemical structure, and conserve materials and the time of the student. The first twelve chapters include the hydrocarbons, the hydrogenated hydrocarbons, the hydroxyl group, ethers, the carbonyl group, the carboxyl group, nitrogen compounds, sulfur compounds, organometallic compounds, dyes, enzymes, glycosides, saponins and tannins. In addition, chapters have been included on qualitative microchemical procedures, dialysis and chromatography. The final chapter outlines in brief a typical library problem.

There can be little doubt that the outline provides ample material to stimulate thought on the part of the student. A total of 307 exercises are included in the outline.

The arrangement of the material in the first twelve chapters is uniform in style and consists almost exclusively of brief but concise directions for carrying out the various tests, a list of the necessary reagents for each series of tests and numerous questions based upon

the students observations of the tests he performs. No clues or suggestions are supplied anywhere in the outline as to where these answers are to be found, this responsibility being left to the student. It is obvious that numerous textbooks and literature references will have to be consulted for this purpose.

In general, this outline may be regarded as a guide to the qualitative organic chemistry usually applied to the characterization of organic compounds, but differing from other published outlines in this field by being restricted to organic compounds having recognized therapeutic properties.

The authors fail to state in the preface just where this course belongs in the pharmacy curriculum, but they do refer to the desirability of developing laboratory aspects of organic medicinal substances at both the undergraduate and the graduate levels. Since many of the schools of pharmacy consider the characterization of organic compounds as a subject appropriate for the graduate level, there is some question in the mind of the reviewer as to the ability of the undergraduate student who has no preparation beyond the beginning course in organic chemistry to deal successfully with all of the work contained in the manual. Certainly it would be necessary for the student to possess a degree of familiarity with the textbook literature and other sources of information which is not ordinarily attained by the undergraduate student at this stage of his development. In the opinion of the reviewer, the outline would be better suited to the needs of the undergraduate students, if it is the intention to use it for this purpose, and the burden imposed on the student could have been lightened considerably, had appropriate literature references been included for his guidance.

J. B. B.

Teachers' Manual for Drug Store Management by Herman C. Nolen and Harold H. Maynard, Professors of Marketing, Ohio Ctate University, in collaboration with Edward E. Garrison, Assistant Professor of Marketing, University of Tennessee, and coordinator of Distributive Education. 93 pp. The National Wholesale Druggists' Association, 330 West 42nd St., New York 18, N. Y. 1946. Price $1.00.

As indicated by the title, this manual has been prepared as a guide for teachers and is based upon the well-known textbook, **Drug Store Management** by Herman C. Nolen and Harold C. Maynard (McGraw-Hill Book Company, Inc., New York and London, 1941,) Its preparation was sponsored by the National Wholesale Druggists' Association in response to many requests from teachers in schools and colleges of pharmacy, pharmacists, and salesmen of manufacturing and wholesale drug houses, and it is designed, as was the textbook for which it serves as a guide, for use in the training program for students in colleges of pharmacy as well as for training salesmen within the drug industry.

The material in this manual has been developed, according to the authors' statement in the preface, to serve as a course of study on the management of an up-to-date and successful drug store, to provide a guide for the construction of lesson plans by the instructor and to suggest methods, questions and problems as aids to teaching the course.

The material is presented in outline form and shows evidence of careful and painstaking preparation. Separate outlines are given for each of the thirty chapters of the textbook, and the material in each is arranged in accordance with a uniform plan.

The general scheme for each outline includes: (1) a statement of the aims and objectives of the teacher, based upon the materials to be presented and the information to be imparted; (2) course of study suggestions with comments; and (3) suggested methods and devices for the guidance of the instructor. Each outline also includes two exercises to be completed by students, the first of which (Section A) consists of true and false statements and the second (Section B) is a list of questions and problems based upon material found in the textbook.

The material in the course of study suggestions and the suggested teaching methods and devices are especially valuable to the instructor, while the material in the exercises has been developed in such a way as to stimulate thought and careful study by the student and to insure that proper emphasis is placed upon the more important parts of the textbook material.

In the opinion of the reviewer, the manual represents a most excellent aid to the teaching of a course base upon **Drug Store Management** as a textbook, and it is believed that most instructors teaching such a course will decide, after examination of the manual, to adopt it for use in teaching the course. It should also be noted that the manual will be especially useful as a guide to new instructors or those of limited teaching in this field. J. B. B.

Placement Service

University of Florida, School of Pharmacy.—A number of graduate fellowships, scholarships, and assistantships will be available for the year 1947-1948 at stipends ranging from $600 to $1000.

Medical College of Virginia.—Has available an assistant professorship, or lower rank, in the department of pharmacy, depending upon qualifications. Some choice will be allowed in courses taught. Applicants should address Dean W. F. Rudd or Dr. K. L. Kaufman, Medical College of Virginia, Richmond 19, Virginia.

State College of Washington, School of Pharmacy.—Two faculty positions, one in pharmacy and one in pharmacognosy. Rank and salary open, depending upon training and experience of candidates. Four graduate-teaching assistantships, requiring one-half time service per week and paying $900 for the school year. Inquiries should be addressed to Dean P. H. Dirstine, Pullman, Washington.

University of Washington, College of Pharmacy.—The following is a list of scholarships and fellowships which are available for 1947-48:
Undergraduate:

Two American Foundation for Pharmaceutical Education, $200 each.

Six Edna B. Quick, $25,000 gift at 2½%, $100 each.

One McKesson & Robbins, $50.

One Washington State Pharmaceutical Association, $100.

Four Women's Auxiliary, Women's State Pharmaceutical Association, $25 each.

Graduate:

One American Foundation for Pharmaceutical Education, $1500.

One Arthur A. Denny Fellowship, $500.

Nine University of Washington Teaching Fellowships, $900 each.

University of Tennessee, School of Pharmacy at Memphis.—A full time teaching position in theory and practice of pharmacy. A corresponding position in botany and pharmacognosy.

University of North Carolina.—Has the following grants available. Applications should be directed to Acting Dean M. L. Jacobs,

Two teaching assistantships at $450 for 9 months with exemption from tuition and certain laboratory fees. The total time required in teaching is from 12 to 15 hours per week.

Four research fellowships at $1,000 each from the North Carolina Pharmaceutical Research Foundation, Inc.

One research fellowship at $750 on the pharmaceutical applications of iso-propyl alcohol.

One at $500 on the chromatographic study of cinchona and its preparations.

University of Nebraska, College of Pharmacy.—Five $500-$750 graduate teaching assistantships with remission of fees. Half-time service required. One $1000 graduate research fellowship. Given by the Sioux Honey Association for the investigation of honey bearing plants.

New in the Family

Michael David Gross.—Born December 16, 1946, son of Mr. and Mrs Guilford C. Gross, South Dakota State College, Division of Pharmacy.

Susan Kristine Smith.—Born December 9, 1946, daughter of Assistant Dean and Mrs. R. Blackwell Smith, Jr., Medical College of Virginia.

Carol Lee Sprowls.—Born December 15, 1946, daughter of Dr. and Mrs. Joseph B. Sprowls, University of Buffalo.

Albert J. Sica, Jr.—Born November 10, 1946, son of Prof. and Mrs. Albert J. Sica, College of Pharmacy, Fordham University.

Margaret Suzanne Login.—Born October 11, 1946, daughter and first child of Mr. and Mrs. Larry Login, Long Island University.

Donna Flauto.—Born December 8, 1946, daughter of Mr. and Mrs. Ralph Flauto, second granddaughter of Prof. and Mrs. Berl S. Alstodt, Long Island University.

Sarah Reed Skinner.—Born November 18, 1946, daughter of Mr. and Mrs. Joseph Skinner, Massachusetts College of Pharmacy.

Robert LeSourd Bradley.—Born July 1, 1946, son of Mr. and Mrs. Willis T. Bradley, Massachusetts College of Pharmacy.

The American Pharmaceutical Association has become a member of the National Society for Medical Research, thus joining with other professional groups in a new endeavor to place the true facts on animal experimentation before the bar of public opinion and to combat antivivisectionist pressure.

In a recent article in the Association's Journal, Drs. A. C. Ivy and A. F. Zobel of the National Society for Medical Research state: "Current controversy about the use of animals in medical research, fomented by well-meaning but misinformed people, presents a challenge for the pharmacist. For he knows better than most professional men that the triumphs of modern medicine—such as penicillin, sulfonamides, insulin, plasma transfusions, and many others—would have been impossible without exhaustive animal experiments. He knows that medical science cannot hope to score victories in the fight against cancer, tuberculosis, infantile paralysis and other scourges of humanity without large-scale animal experiments. . . . To educate is a duty of those who know," pharmacists are told. "The pharmacist can do much to enlighten his friends and clients on the subject because he is an influential molder of public opinion, especially in regard to drugs and medicines."

FELLOWSHIPS AWARDED BY A. F. P. E.

The Board of Grants of the American Foundation for Pharmaceutical Education announces the following awards of fellowships for graduate work in pharmaceutical subjects. These students are now registered in the Graduate Schools of the institutions named, and are pursuing graduate work leading to either the Master of Science degree or the Doctor of Philosophy degree. These students are known as "Fellows of the American Foundation for Pharmaceutical Education."

The recipients of Foundation fellowship awards already possess their bachelor of Science degree in pharmacy, or equivalent, and submitted with their formal application high collegiate grades. From one to three years of time will be required for them to earn their graduate degrees. They plan on either going into teaching in the pharmaceutical field, or to serve in the research laboratories of pharmaceutical manufacturers. The Foundation Board of Grants is now receiving applications from students who desire to secure new Foundation fellowship awards for the opening of the fall semester in 1947. It is the hope of the Foundation that at least sixty awards may be made for the coming year.

CLARK A. ANDRESON—awarded July 24, 1946—for work leading to Master of Science in Pharmaceutical Chemistry at North Dakota Agricultural College.

JULIUS APPEL—awarded August 23, 1946—for work leading to Master of Science in Pharmaceutical Chemistry at Philadelphia College of Pharmacy & Science.

MARTIN BARR—awarded September 12, 1946—for work leading to Master of Science in Pharmacy at Philadelphia College of Pharmacy & Science.

WOODROW R. BYRUM—awarded March 29, 1946—for work leading to Ph. D. degree in Pharmacy at Ohio State University.

GILMAN N. CYR—awarded March 29, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at Purdue University.

ROY C. DARLINGTON—awarded March 29, 1946—for work leading to Ph. D. degree in Pharmacy at Ohio State University.

CHARLES ERDELJON—awarded July 24, 1946—for work leading to Master of Science in Pharmaceutical Chemistry at University of Cincinnati.

A. F. HADDAD—awarded October 21, 1946—for work leading to Master of Science in Pharmacy at Philadelphia College of Pharmacy & Science.

ALFRED HALPERN—awarded July 24, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at State University of Iowa.

MARIAN L. LIEN—awarded July 24, 1946—for work leading to Master of Science in Pharmaceutical Chemistry at North Dakota Agricultural College.

ROBERT S. McCUTCHEON—awarded August 29, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at University of Washington.

STANLEY G. MITTELSTAEDT—awarded July 24, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at Purdue University.

ARNOLD C. NEVA—awarded July 24, 1946—for work leading to Ph. D. degree in Pharmacognosy at University of Minnesota.

CHARLES E. POETSCH—awarded July 24, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at University of Wisconsin.

STUART FUN QUAN—awarded March 29, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at University of California.

ANTHONY S. RIDOLFO—awarded March 29, 1946—for work leading to Ph. D. degree in Pharmacy at Ohio State University.

DONALD SKAUEN—awarded July 24, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at Purdue University.

KENNETH H. STAHL—awarded September 12, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at State University of Iowa.

CHARLES H. SPRAGUE—awarded March 29, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at Purdue University.

ROBERT L. VAN HORNE—awarded July 31, 1946—for work leading to Ph. D. degree in Pharmacognosy at State University of Iowa.

WALLACE F. WHITE—awarded March 29, 1946—for work leading to Ph. D. degree in Pharmacology at Yale University.

JOSEPH A. ZAPOTOCKY—awarded July 24, 1946—for work leading to Ph. D. degree in Pharmaceutical Chemistry at Ohio State University.

In making this announcement, Dr. E. L. Newcomb, Secretary of the Foundation, made the following statement:

"These pharmacy students who are going into graduate work for either their Master of Science or Doctor of Philosophy degrees in pharmaceutical subjects will, when they complete their work, supply the new teachers for our colleges of pharmacy and new research workers for manufacturers. There is a very great shortage of both pharmacy teachers and qualified research workers in the laboratories of our manufacturers."

INSTITUTIONS HOLDING MEMBERSHIP IN THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

New Jersey

Rutgers University, The State University of New Jersey, New Jersey College of Pharmacy, Newark (1923)
Thomas D. Rowe, Dean

New York

University of Buffalo, School of Pharmacy, Buffalo. (1939)
A. B. Lemon, Dean

Columbia University, College of Pharmacy of the City of New York. (1939)
Charles W. Ballard, Dean

Fordham University, College of Pharmacy, New York. (1939)
James H. Kidder, Dean

Long Island University, Brooklyn College of Pharmacy, Brooklyn. (1939)
Hugo H. Schaefer, Dean

Union University, Albany College of Pharmacy, Albany. (1945)
Francis J. O'Brien, Dean

North Carolina

University of North Carolina, School of Pharmacy, Chapel Hill. (1917)
Marion L. Jacobs, Acting Dean

North Dakota

North Dakota Agricultural College, School of Pharmacy, Fargo. (1922)
William F. Sudro, Dean

Ohio

Ohio Northern University, College of Pharmacy, Ada. (1925)
Rudolph H. Raabe, Dean

The Ohio State University, College of Pharmacy, Columbus. (1900)
Bernard V. Christensen, Dean

University of Toledo, College of Pharmacy, Toledo. (1941)
Charles H. Larwood, Dean

Western Reserve University, School of Pharmacy, Cleveland. (1902)
Arthur P. Wyss, Dean

Oklahoma

University of Oklahoma, School of Pharmacy, Norman. (1905)
D. B. R. Johnson, Dean

Oregon

Oregon State College, School of Pharmacy, Corvallis. (1915)
George E. Crossen, Dean

Pennsylvania

Duquesne University, School of Pharmacy, Pittsburgh. (1927)
Hugh C. Muldoon, Dean

Philadelphia College of Pharmacy and Science, Philadelphia. (1900)
Ivor Griffith, Dean

Temple University, School of Pharmacy, Philadelphia. (1928)
H. Evert Kendig, Dean

University of Pittsburgh, Pittsburgh College of Pharmacy, Pittsburgh. (1900)
Edward C. Reif, Dean

Philippines

University of the Philippines, College of Pharmacy, Manila. (1917)
Patrocinio Valenzuela, Dean

Puerto Rico

University of Puerto Rico, College of Pharmacy, Rio Piedras. (1926)
Luis Torres-Diaz, Dean

Rhode Island

Rhode Island College of Pharmacy and Allied Sciences, Providence. (1926)
W. Henry Rivard, Dean

South Carolina

Medical College of the State of South Carolina, Charleston. (1940)
William A. Prout, Director

University of South Carolina, School of Pharmacy, Columbia. (1928)
Emery T. Motley, Dean

South Dakota

South Dakota State College, Division of Pharmacy, Brookings. (1908)
Floyd J. LeBlanc, Dean

Tennessee

University of Tennessee, School of Pharmacy, Memphis. (1914)
Robert L. Crowe, Dean

Texas

University of Texas, College of Pharmacy, Austin. (1926)
William F. Gidley, Dean

Virginia

Medical College of Virginia, School of Pharmacy, Richmond. (1908)
Wortley F. Rudd, Dean

Washington

State College of Washington, School of Pharmacy, Pullman. (1912)
Pearl H. Dirstine, Dean

University of Washington, College of Pharmacy, Seattle. (1903)
Forest J. Goodrich, Dean

West Virginia

West Virginia University, College of Pharmacy, Morgantown. (1920)
J. Lester Hayman, Dean

Wisconsin

University of Wisconsin, School of Pharmacy, Madison. (1900)
Arthur H. Uhl, Director

FELLOWSHIPS IN PHARMACY

To meet the demonstrated need for trained teachers and researchers in the field of pharmacy, the American Foundation for Pharmaceutical Education announces a limited number of Fellowships for students seeking graduate degrees in pharmaceutical subjects.

These Fellowships are open to students (men or women) qualified for registration in approved graduate schools (or colleges) for one or more of the following major fields:

PHARMACY

PHARMACEUTICAL CHEMISTRY

PHARMACOLOGY

PHARMACOGNOSY

(or closely related subjects)

Each Fellow will receive from the Foundation a stipend to cover the year of his appointment, plus an allowance for tuition and miscellaneous term bills. Fellowships are renewable for one year.

For further information concerning Foundation Fellowships, including application forms, write directly to the

Board of Grants,
AMERICAN FOUNDATION FOR PHARMACEUTICAL EDUCATION

330 West 42nd Street **New York 18, N. Y.**